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USSR Report

ELECTRONICS AND ELECTRICAL ENGINEERING

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USSR REPORT
ELECTRONICS AND ELECTRICAL ENGINEERING

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SPECIAL PURPOSE SIGNAL PROCESSOR

Riga IZVESTIYA AKADEMII NAUK LATVIYSKOY SSR in Russian No 3, Mar 86
(manuscript received 22 Dec 84) pp 103-109

[Article by I. B. Medniyek and A.K. Mikelson, Institute of Electronics
and Computing Technology, Academy of Sciences Latvian SSR]

[Abstract] The processor is described of a rapid discrete Fourier transform (PRDFT) which makes it possible to conduct a spectral analysis of wide-band signals in the composition of a measuring-computing complex based on the Elektronika-60 microcomputer or the SM3 and SM4 minicomputers. The PRDFT is an improved modification of the AS-16 digital spectrum analyzer for measuring-computing complexes described in a 1982 article from the above journal. The PRDFT performs an analog-digital transform and a computation of the Fourier coefficients of the signal under investigation. The computer provides reprogramming of the special processor, control of the experiment, further treatment of the Fourier coefficients in order to realize various algorithms for digital treatment of signals, storage and presentation in convenient form of the results of analysis, as well as checking of the efficiency of the basic units of the PRDFT. Figures 2; references: 5 Russian.

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INTERFERENCE IMMUNITY OF SIGN DETECTOR AND RANK DETECTOR IN PRESENCE OF NOISE
AND RANDOM PULSE INTERFERENCE

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 29,
No 4, Apr 86 (manuscript received after revision 3 Jun 85) pp 25-30

[Article by P.S. Akimov, M.N. Biryukov, and V.Ya. Litnovskiy]

[Abstract] Nonparametric signal processing by a sign detector or a rank detector is analyzed for interference immunity in the process of noise and random pulse interference, both double-hit detectors being characterized by a constant false-alarm probability in the presence of homogeneous interference

regardless of its form and distribution. Each detector decides about presence or absence of a signal after its statistic has been compared with the detection threshold, the statistic of a sign detector being a sum and the statistic of a rank detector being a sum of sums. In the case of a single channel, therefore, a rank detector degenerates into a sign detector. For calculating the false-alarm probability and the probability of detection as composite measure of interference immunity, the sequence of interference pulses is assumed to constitute a Poisson flux and thus one without aftereffect. They are calculated on the basis of the noise distribution function and three mixture distribution functions, these three mixtures being noise + interference pulse, signal + noise, and signal + noise + interference pulse. While the probability of detection with each detector is found to depend on the probability density of noise and of those three mixtures, the false-alarm probability with each detector is found not to be influenced by a random pulse interference and thus not to depend on the parameters of the latter. Both a sign detector and a rank detector, accordingly, retain their nonparametricity in the presence of random pulse interference and therefore their advantages wherever electromagnetic compatibility is a problem. Figures 3; references 5: 4 Russian, 1 Western (in Russian translation).

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RECEPTION OF SIGNAL WITH UNKNOWN TIME DELAY IN PRESENCE OF MODULATING INTERFERENCE

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian
Vol 29, No 4, Apr 86 (manuscript received 18 Jan 85) pp 36-41

[Article by A.P. Trifonov and A.V. Zakharov]

[Abstract] A maximum-likelihood receiver is synthesized for detection of pulse signals which appear together with modulating or multiplicative Gaussian interference in the presence of Gaussian white background noise and with a time delay, this time delay being unknown but lying within the a priori range $-\frac{1}{2}T_0, \frac{1}{2}T_0$. Within a time interval $-\frac{1}{2}T, \frac{1}{2}T$ at the receiver input appears either the noise alone or a mixture of that noise and a pulse signal parasitically modulated by the interference. The receiver must then compute the logarithm of a functional, the maximum-likelihood ratio, for all time delays within the a priori $-\frac{1}{2}T_0, \frac{1}{2}T_0$ range, assuming that signal and noise are statistically independent processes and that the pulse duration is much longer than the interference correlation time. The receiver establishes presence or absence of a signal by comparing the absolute maximum logarithm of the maximum-likelihood ratio with the threshold and estimates the time delay with certain bias and dispersion. Figures 1; references: 8 Russian.

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DISCRETE PHASE DETECTOR OF HARMONIC SIGNAL

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian
Vol 29, No 4, Apr 86 (manuscript received 26 Feb 85) pp 41-47

[Article by K.D. Fedotov and V.M. Chilikin]

[Abstract] The performance of a discrete phase detector behind an intermediate-frequency amplifier is analyzed, considering that at its input appears either a mixture of noise and a harmonic signal or noise alone. Amplitude and frequency deviation of the signal are assumed to be known, its initial phase being a random quantity. A typical such phase detector discretizing the orthogonal signal components contains an amplitude limiter, a coherently storing filter, an amplitude detector, and a noncoherently storing filter. The noise is assumed to be a normal stationary random process with a given dispersion and with a correlation time not longer than the discretization period, the noise complex-amplitude sampling period being independent of the signal discretization period. Analytical expressions are derived on this basis for both the probability of detection and the false-alarm probability, two special cases being a detector without noncoherent storing and a detector with a coherently storing discrete filter whose transfer function is a finite but long sum. Numerical calculation of both detector characteristics was carried out by a computer. Figures 2; tables 3; references: 6 Russian.

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EXTRACTION OF SIGNALS WITH SINGLE-SIDEBAND MODULATION BY COMPLEX DIGITAL FILTRATION

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian
Vol 29, No 4, Apr 86 (manuscript received after revision 15 Aug 85) pp 48-53

[Article by V.I. Bitvutskiy and V.A. Kozmin]

[Abstract] The feasibility of using a complex digital filter for detection of signals with single-sideband amplitude modulation is demonstrated, such a signal being first split into its inphase and quadrature components by means of a Gilbert resolver at the receiver input. During simultaneous discretization of both signal components by respective analog-to-digital converters, with a discretization frequency equal to a submultiple of the frequency of the suppressed carrier, signals in both forward and reverse channels become demodulated with mutually nonoverlapping spectra. The next step is extraction of the useful signal in the operating channel from the noise signal in the adjacent idle channel and from internal channel interference. This, usually achieved by phase compensation of the idle signal, can also be achieved by

complex digital filtration of the orthogonal signal components. Unlike phase compensation, complex digital filtration is selective and thus immune to interference in the operating channel so as not to require subsequent low-frequency filtration. Calculations by the method of complex amplitudes yield the level of idle signal suppression and indicate the necessary filter performance and design characteristics. A sixth-order complex digital filter is adequate for voice communication channels, but the resolver must be as precise as for phase compensation. Figures 3; references 4: 3 Russian, 1 Western.

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CHARACTERISTICS OF SIGNAL PROCESSING IN MODERN SURVEILLANCE RADARS: REVIEW

Kiev IZVESTIYA VYSSHIKH UCHEBNIKH ZAVEDENIY: RADIOELEKTRONIKA in Russian
Vol 29, No 4, Apr 86 (manuscript received 19 Nov 85) pp 4-20

[Article by P.A. Bakulev and V.M. Stepin]

[Abstract] The purpose of a surveillance radar is detection of moving targets, especially low-flying ones in the case of air traffic control. Such a radar must be capable of extracting relevant information and does so by appropriate processing of input signals. Primary processing involves detection of useful signals reflected by targets with given probability characteristics but submerged in noise and interference, then forming radar markers and measuring or estimating their coordinates with attendant statistical estimation of target location as well as of target shape and size. Secondary processing involves detection and tracking of target trajectories, and mapping all passive interference in azimuth-range coordinates. Tertiary processing involves combining the information from several radars with a common secondary processing system and with overlapping detection zones about targets located within those regions of overlap, also identification of target trajectories and calculation of composite trajectories. Modern surveillance radars are capable of detecting useful signals submerged in strong passive interference, natural or man-made, without exceeding a given level of false alarm probability. The problem of designing such a radar, with moving target detector and means of maintaining a constant false-alarm probability, reduces to selection or synthesis of the optimum probing signal, selection or synthesis of the optimum detector scheme, and selection of most suitable hardware. The choice of the probing signal determines not only the feasibility of attaining the required radar performance characteristics but also size and cost of the radar equipment. The efficiency of a moving target detector in turn depends on the wavelength and the polarization mode as well as on the pulse duration and repetition period of the probing signal, also on the size of the resolution element. As the size of the resolution element is increased, the interference power increases proportionally while the power of the signal from a target located within that element remains constant. Radars with spread-spectrum probing signal for better secrecy and pulse-Doppler radars operating at medium pulse repetition rates (20 kHz) rather than at less advantageous high or low ones and with internal linear frequency modulation (linearly decreasing carrier frequency) have been developed for

surveillance. Radar data are processed first in the antenna and microwave channels, important techniques for efficient extraction of information here being control of the antenna radiation pattern and especially of its lower edge with suppression of side lobes, control of the directive gain, automatic beam switching in 2-beam antennas most expedient for air traffic control, and use of phased antenna arrays. Information proceeds to the intermediate-frequency channel, where its processing is facilitated by instantaneous automatic gain control or by use of an amplifier with logarithmic gain characteristic, but most effectively by adaptive automatic time gain control using a logarithmic amplifier followed by an antilog circuit with a small-time-constant stage between them. A further improvement of this technique is inclusion of a programmed adaptive attenuator of passive interference. From here information proceeds to the video channel of the moving target detector. The first-generation version of this detector includes a band elimination filter supplemented or replaced with a comb of narrow-band Doppler filters synthesized by fast Fourier transformation and followed by a weighting device, in parallel with a low-pass filter followed by a modulus calculator, both filter branches feeding into a threshold device and the low-pass filter through the modulus calculator also feeding into a filter for mapping passive interference. The second-generation version of a moving target detector includes an array of phase detectors with control for constant false-alarm probability, an array of analog-to-digital converters, and a memory for storage of digital data over the period of coherent processing of the pulse packet, namely their Doppler filtration and comparison with threshold levels, also a correlator-interpolator, a device which generates adaptive thresholds, a comparator which generates target markers, and an interscan correlator. Targets are now tracked by the track-while-scan method with continuous input of new data to prevent "loss" of target, and one of the latest methods of optimum information processing is based on the maximum entropy principle. An important factor is precise balancing of the in-phase channel and the quadrature channel, because any mismatch of their amplitude and phase characteristics can produce a parasitic image component shifted from the useful signal. A procedure has been developed for signal detection under conditions of a priori indeterminacy, namely the adaptive Bayes procedure that minimizes not the a posteriori risk as exact measure of loss but its estimate, this procedure being applicable whether the indeterminacy is parametric or nonparametric. Figures 6; tables 1; references 76: 24 Russian, 52 Western (2 in Russian translation).

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EFFICIENCY OF SQUARE-LAW COMPENSATORS OF PASSIVE INTERFERENCE IN NONCOHERENT RADARS

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian
Vol 29, No 4, Apr 86 (manuscript received after revision 19 Jun 85) pp 75-80

[Article by A.Z. Kiselev]

[Abstract] A square-law compensator, more generally a linear compensator + squarer + integrator, is placed behind the amplitude detector in noncoherent radars for suppression of passive interference and extraction of the moving target signal. Its asymptotic efficiency is calculated here, assuming that the amplitude detector is also a square-law device preceded by a linear receiver channel. The useful signal coming from that channel appears at the detector input generally mixed with interference and noise, both assumed to be stationary Gaussian processes with zero mean and typical spectral densities. A simple compensator and a multichannel one are considered, their performance being characterized by the quantity $k = (a_1 - a_0)^2 / D_0(a_\theta, b_\theta)$ - mathematical expectation and dispersion of the compensator output signal as a random quantity, $\theta = 0, 1$ denoting respectively absence and presence of useful signal) so that the probability of detection will then be $P = 1 - I(I^{-1}(1-F) - \sqrt{k})$ (F - false-alarm probability, I - integral normal-distribution function). After an analytical expression for the quantity k in terms of process statistics has been derived, the asymptotic efficiency of such compensators is calculated for the purpose of optimization. The analytical relations reveal that there is an optimum number of compensating pulses for a simple compensator and that the efficiency of a simple compensator with this number of compensating pulse approaches the efficiency of a multichannel compensator, channels of the latter not being equivalent and the number of efficiently operating ones being smaller than the number of processed pulses. Numerical results are shown for the case of a correlated interference which includes a not time-correlated noise component. Figures 3; references 9: 8 Russian, 1 Western (in Russian translation).

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CHARACTERISTICS OF DIGITAL COMPENSATOR WITH ORTHOGONAL TRANSFORMATION OF SPACE-CORRELATED EXTERNAL NOISE

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian
Vol 29, No 4, Apr 86 (manuscript received after revision 2 Jul 85) pp 103-105

[Article by A.K. Zhuravlev and O.N. Mashtakov]

[Abstract] The performance of a digital autocompensator with orthogonal transformation of the input signal and with correlated feedback for

suppression of space-correlated external noise is analyzed, considering that the weighting factors are elements of a plane-rotation matrix with the angle of rotation as control parameter estimated on the basis of sampled instantaneous values of voltage read in the main channel and in the compensation channel. The characteristics of such a compensator were calculated by computer-aided statistical simulation in four cases: 1) with precision of weighting coefficients limited by the computer word format only; 2) with weighting factors replaced by their logarithms, for compressing the dynamic range of received signals; 3) with logarithms of the weighting factors quantized into a sufficient number of levels to ensure adequate noise suppression; 4) with quantization of those logarithms and with nonpulse estimation of the control parameter (rotation angle) in a limited computer word format. Calculations made for equal and different interference intensities in the two receiver channels, considering differences up to 10 dB, reveal that such a compensator parametrizes the control of weighting factors, computes the control parameter and the smoothing factors separately and facilitates an appreciable compression of the dynamic amplitude range. Its dynamic and asymptotic characteristics remain near optimum with an 8-digit representation of the control parameter and a 2-digit representation of the smoothing factors. *References: 2 Russian.*

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MULTILEVEL CLAMPING OF SIGNAL POSITION IN TIME

Kiev IZVESTIYA VYSSHIKH UCHENYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian
Vol 29, No 4, Apr 86 (manuscript received after revision 6 Aug 85) pp 100-104

[Article by B.V. Ponomarenko and L.I. Chukmoev]

[Abstract] The position of a pulse signal in time is measured by clamping, optimally by clamping the peak of the receiver output signal in the presence of noise or suboptimally by clamping on the basis of a relative signal level and two readings at the signal edges. The latter method becomes nonoptimal in the presence of multiplicative interference and, therefore, multilevel clamping is proposed for such a situation. The gist of this method is obtaining several position estimates during one realization of the input process. The procedure is demonstrated for the case of an interference with unknown statistical characteristics and an input process realization with an arbitrary number of local extrema, but assuming that a global extremum exists in the vicinity of the true signal position. This is a typical situation where signals appear with arbitrary multiplicative and weak additive interference. The estimator for multilevel clamping in such a case can be constructed according to the algorithm of the psi-transformation method and then approximated for estimating, by statistical tests, the coordinates of the global extremum within a bilateral vicinity of the true ones. A polynomial approximation of both estimator and ψ -clamp with coefficients based on least squares is an expedient one, as demonstrated by the numerical results of computer-aided statistical simulation for an azimuth signal $S(t) = |\sum_{n=1}^N (S_n(t) e^{j\theta_n})|$ and θ .

quasi-harmonic multiplicative interference with modulation $M(t) = 1 + m \cos(2\pi Ft + \gamma)$ appearing in a short-range radio navigation system. These results indicate that a 2-level clamp is much more accurate than a 1-level clamp when the interference frequency is $F < 55$ Hz. When the interference frequency is $F > 55$ Hz, then the errors of a 2-level clamp and of a 3-level clamp increase fast. In the latter case a Ψ -clamp is more accurate than a plain clamp, its error depending very little on the interference frequency. Figures 1; references: 9 Russian.

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LOCALLY OPTIMUM PHASE-KEYED SIGNALS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 31, No 1, Jan 86
(manuscript received 3 Jul 84) pp 78-87

[Article by E.Ye. Mitselmager]

[Abstract] For better tracking of radar targets in the presence of clutter, it is desirable to use phase-keyed signals whose both autocorrelation function and indeterminacy function have small side lobes within the local regions in the (τ, Ω) plane (τ - time delay, Ω - Doppler frequency shift) where the clutter appears. Aperiodic code sequences of N elements are proposed for synthesis of such signals. Locally optimum signals with a locally optimum interval of maximum length are synthesized on a digital computer according to the general criteria of optimality for phase-keyed signals. Locally optimum or quasi-optimum signals with arbitrarily many discrete elements are synthesized by a regular method, using the cross-correlation function of aperiodic code sequences and, in accordance with a fundamental theorem, a relevant vector equality for any N -element compound aperiodic code sequence consisting of n s -element sequences. Generating sequences which ensure local quasi-optimality of aperiodic code sequences are then synthesized, with various recurrence schemes available for "lengthening" them. While complementary sequences are required for synthesis of central locally optimum or quasi-optimum signals, peripheral locally optimum or quasi-optimum signals can be synthesized with entirely arbitrary not complementary sequences. Two central 528-element locally quasi-optimum signals with a central minimality region $[|\tau| < 16\tau_0, |\Omega| < 7.25 \cdot 2\pi/T]$ have been synthesized, for illustration, and compared with a 511-element truncated M-sequence and with an 8 times repeated 63-element M-sequence. Maximum and rms values of the modulus of the indeterminacy function squared indicate that the advantages of a locally quasi-optimum or optimum signal become more evident as the range of the Doppler frequency shift narrows. Figures 4; tables 2; references 11: 10 Russian, 1 Western.

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CONCERNING A METHOD FOR ADAPTIVE PROCESSING OF SIGNALS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 31, No 2, Feb 86 (manuscript received 10 May 84) pp 292-297

[Article by N.I. Klierin, N.I. Mansurov, and N.M. Maslennikov]

[Abstract] An analysis was made of the operation of a conjugate-phase system for adaptive processing of signals in radio and optical astronomy. It is possible with the system to correct distortions introduced by the atmosphere and transmission routes, and to conduct signal processing in real time. This method is based on the fact that correcting signals are fed to the controlling elements with a phase opposite to that of the error signals. An analog of such a system was proposed, in the feedback circuit of which a spatial Fourier transform of signals is used. The possibility was shown of constructing the system on the basis of existing microwave elements. Figures 5; references 4: 3 Russian; 1 Western in Russian translation.

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COHERENT-OPTICAL CORRELATOR WITH HYBRID MODULATION OF SPATIAL CARRIER

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 31, No 2, Feb 86 (manuscript received 18 June 84) pp 298-307

[Article by V.A. Yezhov]

[Abstract] A method for correlation comparison of signals, based on the use of a spatial carrier, with combined recording of these signals, was theoretically and experimentally investigated. It was shown that by the use of the respective degrees of freedom of the spatial carrier it is possible jointly to record on one and the same transparency not only the amplitudes (real) but also the phase signals, and to accomplish their treatment in accordance with a formula furnished in the article. The author thanks V.N. Ledochnikov for assistance in obtaining experimental results. Figures 7, references 11: 5 Russian (2 concerned with foreign electronics), 6 Western (1 in Russian translation).

6415/9716

CSO: 1860/241

UDC 621.396.67.029

ANTENNA AND FEEDLINE CONFIGURATIONS FOR SHF AND EHF SPACE COMMUNICATIONS
SYSTEMS (REVIEW)

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian
Vol 29, No 2, Feb 86 (manuscript received 24 Jul 85) pp 4-15

[Article by N.S. Arkhipov, L.V. Bondar, A.G. Vitovtsev and V.I. Loman]

[Abstract] Predominantly American and Japanese literature is reviewed to provide a systematic overview of antenna and feedline designs for millimeter wavelengths, primarily as applied to space communications. When communications link reliability is to be greater than 99.9%, special measures are required for the utilization of EHF frequencies: duplication of the EHF with SHF coverage; use of diversity reception for satellite communications; control of the transmitter power and the use of error correcting codes. Successful designs found in the literature for these techniques with the following major types of space communications hardware are discussed in some detail: permanent and mobile ground stations, ship-based antenna systems as well as those installed in aircraft and space-based repeaters. Performance parameters are summarized for each of these system types. The largest problem area remains the design of mobile systems for various transport vehicles or aircraft. The transition to high SHF and low EHF frequencies has not markedly facilitated the design of space communications antenna systems, since there has not been any substantial reductions in the overall size of the systems. The concomitant increase in losses in traditional feedline components necessitates more work on the coupling of the antenna radiator to the electronics, especially when several functions and frequencies are combined in the antenna system. The development of a standardized antenna and feedline configuration that minimizes losses and employs a well-developed component base is an acute problem at present. Figures 14, tables 5, references 32: 6 Russian, 25 Western; 1 Western in Russian translation.

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SCAN SECTOR BROADENING IN DUAL FREQUENCY ALIGNED PHASED WAVEGUIDE ANTENNA ARRAYS

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian
Vol 29, No 2, Feb 86 (manuscript received 1 Jul 85) pp 36-41

[Article by L.I. Ponomarev, V.I. Stepanenko and M.Yu. Kulkov]

[Abstract] The surface utilization factor and scan sector width of a dual frequency aligned phased waveguide antenna array can be increased by: 1) Reducing the level of the diffraction and spurious sidelobes due to re-reflection by the low frequency elements; 2) Reducing the power delivered to the passive low frequency radiators; 3) Matching the excited high frequency radiators. The first two of these techniques can be realized by changing the amplitude-phase distribution within the scanning sector or by shorting-out the apertures of the low frequency elements using special microwave inserts. The change in the radiation patterns of such dual frequency phased arrays is graphed as a function of the thickness of the inserts used to match the radiators. The graphs show that with an appropriate choice of insert geometry and dielectric permittivity, both the matching and the surface utilization factor can be improved for the array. However, the matching of the high frequency radiators may not improve the surface utilization factor and the gain, if the major losses are due to diffraction and spurious sidelobes, when the inserts increase the latter. The solution of this complex optimization problem of determining the insert parameters to maximize the gain within a specified scan sector and frequency band can be found numerically; this is done for two-layer inserts for fixed directions of the antenna beam. In a sample design, the surface utilization factor of the array was increased by matching from 0.672 without the inserts to 0.707 with them, while the H-plane scan sector broadened from $\pm 28^\circ$ to $\pm 35^\circ$; the E-plane scan sector practically did not change ($\pm 32^\circ$), because of the high diffraction lobe level. Bandstop filter inserts that short out the apertures of the low frequency radiators can further improve the gain of a dual frequency phased array and widen the scan sector in both planes through the reduction in the supplemental sidelobes due to power dissipation in the low frequency elements and a reduction in the percentage of the power delivered to the low frequency radiators. In such an array, the sidelobes are -30 dB down and the surface utilization factor is 0.995, while the H-plane and E-plane scan sectors are $\pm 53^\circ$ and $\pm 50^\circ$ respectively. No physical configurations or other specifications are given. Figures 3; references: 5 Russian.

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PLANE ELECTROMAGNETIC WAVE SCATTERING BY PERIODIC DIPOLE ARRAY WITH LUMPED AND DISTRIBUTED LOADS

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian
Vol 29, No 2, Feb 86 (manuscript received 25 Jun 85) pp 58-63

[Article by L.I. Ponomarev and A.V. Shatalov]

[Abstract] Frequency selective absorbing structures can be used to improve antenna performance by functioning as selectively reflecting and absorbing shields and filters. Multilayer dipole arrays with a lumped load inserted at an arbitrary point and the load distributed over the dipole length can be used as such absorbing structures, located both over a metal shield and in free space. It is assumed in this analysis of these latter two cases that a plane electromagnetic wave with a specified amplitude and the electric field vector falling in the plane passing through the direction of incidence impinges on the structure. Integral equations are solved for the dipole surface currents in order to describe their electrical behavior as a function of the system geometry. Curves of the reflectance for a single layer structure show that at frequencies above the working band, the reflectance is approximately -1 dB, while below the band, it is -20 to -25 dB. The reflectance outside the working band can be equalized by the appropriate positioning of the dipole array. The algorithm presented here efficiently analyses frequency selective absorbing structures based on dipoles with lumped and distributed loads. Although a considerable absorption of energy from the incident waves is possible in a single layer structure, it has too much reflectance outside the working band and a narrow absorption band. Multilayer structures promise improvements in these two respects, though optimization algorithms have yet to be developed. Figures 3; references: 4 Russian.

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ANTENNAS FOR RADIATING ULTRABROADBAND SIGNALS

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian
Vol 29, No 2, Feb 86 (manuscript received after revision 13 Jul 85) pp 69-74

[Article by V.A. Yatskevich, and L.L. Fedosenko]

[Abstract] Although log-periodic and log-helical antennas have a high gain and input impedance and directional pattern theoretically independent of the bandwidth, they cannot transmit signals with a bandwidth of more than one octave because of the considerable dispersion of the phase-frequency response which distorts the transmitted ultrabroadband waveforms. While post-reception processing can restore the waveform of a signal from a log-periodic antenna, the hardware is complex, reduces the radar speed and assumes exact

knowledge of the absolute value and phase of the antenna frequency response. This paper shows that a simple change in log-periodic antenna geometry can make the necessary correction in the phase response without additional hardware. A variable phase log-periodic dipole antenna is depicted and analyzed for the case where 20 dipoles are used having a diameter/length ratio of 0.01 and a characteristic distribution line impedance of 100 ohms. The phase-frequency response is made to approximate a linear function by changing the normal log-periodic geometry so that the resonant frequencies of the dipoles follow an arithmetic progression. The phase response approximates the linear function with an error of no more than $\pm 15^\circ$ over a frequency range of 3.5:1. The more general and interesting case of the realization of a specified phase-frequency response that is a sufficiently smooth function of frequency and satisfies the conditions of physical feasibility is also analyzed; this analysis is applied to a radar antenna for a system using linear FM signal compression. The proposed method eliminates delay lines and other optimal filtering hardware. In a simple design example, the resulting antenna has an SWR of no worse than 1.42 in a frequency range of 2.3:1, while the phase-frequency response approximates a square law with an error of $\pm 10^\circ$; the gain in this example is about 11 dB over the working band, while the signal power level is nearly quadrupled by virtue of the compression and the S/N ratio is increased by just as many times. Figures 4; references 10: 5 Russian, 4 Western (1 in Russian translation).

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AUTOMATIC CONTROL OF PHASE DISTORTION COMPENSATION IN DEFORMED REFLECTORS OF RADIOTELESCOPES

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 29, No 2, Feb 86 (manuscript received after revision 13 May 85) pp 79-85

[Article by V.A. Puzyrev and A.B. Danilevich]

[Abstract] The phase distortions in the reflector system of a radio telescope can be corrected by controlling the secondary reflector or subdish. Little attention has been devoted to the application of this technique to the compensation for dynamic phase distortions, such as those caused by wind loading deformations. A basic difference between static phase error compensation for sag and similar deformations, and dynamic compensation, is that the latter requires a special fast algorithm executing a set of linear operations using a small data sample. A system is analyzed which automatically steers the secondary reflector; the analysis is handled as a control problem in which the maximized criterion is the normalized surface utilization factor of the deformed antenna. A numerical method is given for the solution of the control optimization problem using a YeS 1033 computer and FORTRAN-IV software. The phase compensation control system is a tracking system in which the master signal for the motion of the secondary reflector is generated by a synthesizer that converts the deformation data measured by sensors at a limited number of

points (up to 60 in the RT-70 radiotelescope) to this master control signal defining the spatial position of the secondary reflector. The synthesizer requires a main memory of 200 to 250 Kbytes. Simulation results showed that the mechanism for the moveable secondary reflector cannot compensate for fast dynamic deformations of a 70 m reflector (fundamental and second harmonic oscillation frequencies of 1.5 Hz and about 3 Hz, respectively), though the system can handle slower dynamic deformations with time constants on the order of tens of seconds. Figures 4; references 8: 4 Russian, 3 Western (1 in Russian translation).

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FAST ANTENNA ARRAY ADAPTATION IN PRESENCE OF SPATIALLY CORRELATED INTERFERENCE

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian
Vol 29, No 2, Feb 86 (manuscript received after revision 1 Apr 85) pp 93-95

[Article by A.K. Zhuravlev and M.V. Yermolin]

[Abstract] When the signal/noise ratio maximum is used as the efficiency criterion for the tuning of adaptive antenna arrays in the presence of interference with apriori indeterminacy, system adaptation is based on the observation of a limited sample of input signals, n . A difficulty is that with small n , the sample matrix proves to be degenerate, thus precluding a unique determination of the optimal algorithm. However, if the external interference is generated by independent point sources M , and the internal noise of the array is uncorrelated, a method is possible that: 1) Permits a simple and computationally efficient algorithm for fast array tuning based on the pseudoinversion of the sample matrix; 2) Both the theory and simulation data confirm the feasibility of fast and stable adaptation through the inclusion of an efficient matrix rank checking procedure; 3) The small teaching sample size and high noise suppression efficiency with a limited processor word length makes it possible to employ the pseudoinversion algorithm when generating the initial approximation of the optimal weighting vector of the samples in conjunction with iterative adaptation procedures for forcing the array tuning. The proposed technique is illustrated with a sample case of a 16-element, equally spaced array with a spacing of one-half wavelength exposed to $M = 1, 3$ and 5 independent gaussian interfering signals; the external interference to internal noise power ratio was 62 dB. When a 16-bit arithmetic floating decimal point processor is used, efficient adaptation is observed when n is greater than M . Figures 1; references: 3 Russian.

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INFLUENCE OF RELIEF AND TERRAIN COVER ON MUTUAL CORRELATION OF RADAR IMAGES

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian
Vol 28, No 3, Mar 86 (manuscript received after revision 29 Jul 85) pp 88-90

[Article by A.M. Berdichevskiy, A.G. Buymov and A.Yu. Shvets]

[Abstract] An analysis is presented on the influence of statistics of relief and type of terrain cover on mutual correlation of radar images made from various positions at various angles. Images were synthesized using a model based on digital simulation of relief with subsequent computation of the effective scattering surface in the approximation of the Huygens-Kirchhoff theory. Figures 2, references 5: Russian.

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MEASUREMENT OF ANTENNA RADIATION PATTERN BY SCAN OF LARGE RADIO SOURCE

Gorkiy IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOFIZIKA in Russian Vol 29,
No 3, Mar 86 (manuscript received 17 Jul 84) pp 328-338

[Article by S.A. Pelyushenko, Scientific Research Institute of Radiophysics]

[Abstract] Determination of the radiation pattern of a radio astronomy antenna from the scan of a large radio source is shown, the antenna response during a scan in one direction being proportional to the convolution of that radiation pattern by the intensity distribution over that radio source. The parameters of the radiation pattern in one of the principal sections are estimated iteratively by the method of least squares with parabolic interpolation, these parameters (constant bias, amplitude, width, and orientation) determining the Gaussian function which approximates that radiation pattern. The mean estimation errors are calculated in the rms approximation. This procedure remains valid over wide ranges of the pattern width to source angle ratio and the signal-to-noise ratio, when checked for accuracy against a separate measurement made with a small radio source. Figures 5; tables 1; references 4: 3 Russian, 1 Western.

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QUASI-WAVE ASYMPTOTIC APPROACH TO DIFFRACTION OF WAVE BY IMPEDANCE CYLINDER WITH ARBITRARY CROSS-SECTION

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 31, No 1, Jan 86
(manuscript received 18 Dec 84) pp 1-7

[Article by R.L. Yevelson]

[Abstract] The problem of diffraction of an ordinary plane wave is solved by the asymptotic quasi-wave method, more accurate than the geometrical-optics approximation in the vicinity of the diffracting surface. A large nonhomogeneous cylinder with arbitrary cross-section and slowly varying impedance is selected as the diffracting body. The corresponding Helmholtz equation contains two arbitrary functions, analogs of an arbitrary amplitude and of the tangential component of the wave vector. It is solved for either E-polarization or H-polarization in the zeroth-order approximation, the boundary conditions being zero radiation at infinity and an impedance constraint at the surface. With this latter constraint transformed from vector to scalar notion, the solution to that equation yields the generalized reflection coefficients and the integral cross-section for scattering. The author thanks Ya.I. Feld for formulating the problem and discussing the results. Figures 1; references 6: 4 Russian, 2 Western (in Russian translation).

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EXPERIMENTAL STUDY OF FLUCTUATING WIND AND ITS EFFECT ON TIME CHARACTERISTICS OF LIGHT WAVE

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 31, No 1, Jan 86 (manuscript received 20 Jun 84) pp 14-19

[Article by Ye.A. Monastyrnyy, G.Ya. Patrushev and V.V. Pokasov]

[Abstract] In order to determine how variations of the wind velocity influence the intensity fluctuations of a quasi-spherical light wave, synchronous measurements were made along two mutually orthogonal tracks respectively parallel and almost perpendicular to the direction of light wave propagation. The electronic and optical instrumentation for this experiment was mounted on two rotatable turrets, portable reflectors were placed in the field 100 m away, the transmitter aperture and the two receivers were spaced 50-80 cm apart. Such an arrangement made it permissible to disregard the effect of double passage through the same refractive inhomogeneities. The horizontal components of wind velocity perpendicular to each track and their fluctuations were measured with acoustic phase anemometers and an M-49 modified anemorhumbometer, the vertical component of wind velocity was not measured. Meteorological conditions were monitored 50 m away at the altitude of wave propagation. Each receiver included

a photomultiplier, an analog-to-digital converter with a maximum discretization frequency of 20 kHz and a dynamic range of 72 dB. The time spectra of light intensity fluctuations and their correlation coefficients have been calculated from the data by the method of fast Fourier transformation, with smoothing over readout segments and over neighboring frequencies so as to allow at least 10^3 degrees of freedom, which yielded estimates of the spectrum with an error not larger than 2% on the basis of a 2-10 Hz resolution over the entire frequency spectrum. The results indicate that the fluctuation component of the transverse velocity of shifting optical inhomogeneities in a wind is not negligible, regardless of the wind direction. The authors thank A.P. Rostov and A.N. Savin for assistance in setting up the equipment and performing the measurements, also T.P. Pecherkina for assistance in performing the computer calculations. Figures 6; references: 12 Russian.

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UDC 537.874.6

REPRESENTATION OF DIFFRACTION FIELDS BY WAVE POTENTIALS AND METHOD OF
AUXILIARY CURRENTS IN DIFFRACTION PROBLEMS FOR ELECTROMAGNETIC WAVES

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 31, No 1, Jan 86
(manuscript received 22 Oct 84) pp 20-27

[Article by A.G. Kyurkchan]

[Abstract] The three-dimensional problem of diffraction of electromagnetic waves is formulated and solved by representing the diffraction field in terms of vector potentials and introducing auxiliary currents, which has validity only when the smallest region outside which the diffraction field is regular is known and the current density is thus definable on any closed surface encompassing this region. Four theorems are stated and proved validating this approach. The first theorem pertains to existence of such a region, a convex shell of diffraction field singularities. The second theorem pertains to the Hertz vectors, electric and magnetic, expressible as surface integrals over a closed Lyapunov surface with a uniquely defined normal and away from sources of the primary field. The last two theorems pertain to solvability of the integrodifferential vector equation of the first kind for the current density on such a surface, a simple case being the surface of an ideally conducting body with only the electric Hertz vector. As an illustrative example is then considered diffraction of a plane electromagnetic wave by an ideally conducting spheroid. The problem is solved in asymptotic expansions, first generally for any ellipsoid and then specifically for an oblate with the convex shell of diffraction field singularities becoming a disk. The author thanks Ya.N. Feld for interest and helpful comments. References 7: 6 Russian, 1 Western.

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EFFECT OF IONOSPHERE ON SIGNAL PARAMETERS DURING RADIOSCOPY OF TERRESTRIAL ATMOSPHERE

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 31, No 1, Jan 86
(manuscript received after revision 12 Jul 84) pp 56-59

[Article by I.E. Kalashnikov, S.S. Matyugov and O.I. Yakovlev]

[Abstract] Probing the terrestrial atmosphere by radioscopy using two satellites is considered, in which case the effect of the ionosphere on radio waves must be accounted for. Expressions for both attenuation and frequency shift of such a signal wave are derived in the approximation of geometrical optics and a spherically symmetric ionosphere, sufficiently accurate for decimetric and shorter waves, with one satellite moving with the earth at a fixed distance R_2 from its center and the other satellite orbiting around the earth at a fixed radius $R_1 < R_2$. The changes in amplitude and frequency due to both refraction of radio waves and motion of satellites are calculated, whereupon the effect of the atmosphere is established by calculation of these changes in vacuum. This method of analysis is demonstrated on a numerical solution of the problem for the terrestrial ionosphere, with the $\lambda = 42$ cm wavelength having been selected for radioscopy. Four altitudinal profiles of electron concentration were used for calculations, profiles corresponding to semi-empirical models of the ionosphere at different times of the day or night, the year, and the solar activity period. The results confirm the disturbing effect of the ionosphere on radioscopy of the atmosphere. Figures 2; references 11: 7 Russian, 4 Western.

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DIFFRACTION OF PLANE WAVE BY DIELECTRIC CYLINDER: OBLIQUE INCIDENCE

Gorkiy IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOFIZIKA in Russian Vol 29, No 2, Feb 86 (manuscript received 20 Jul 84) pp 183-190

[Article by Ye.N. Vasilyev, Z.V. Sedelnikova, and A.R. Seregina, Moscow Institute of Power Engineering]

[Abstract] Diffraction of a plane wave by a dielectric cylinder is analyzed for the general case of oblique incidence, resulting in an entire spectrum of azimuthal harmonics. The integral equation, identical to that describing asymmetric excitation of a dielectric cylinder, is one-dimensional and integration needs to be performed along a meridian only. For numerical integration, this equation is reduced to a system of linear algebraic equations with the sought current approximated as a piecewise-constant function. For each azimuthal harmonic were accordingly calculated the distribution of the equivalent surface currents and the scattered field. On an infinitely long

cylinder would be generated a space wave, finiteness of the cylinder gives rise to an edge effect with each end becoming an exciter of a surface wave. The scattering patterns were calculated for a cylinder 30λ long (λ - wavelength of incident radiation) and incidence angles $0, 10^\circ, 30^\circ, 60^\circ, 90^\circ$ to the cylinder axis with either E-polarization or H-polarization. The results reveal that with decreasing incidence angle the contribution of the surface wave at the leading end increases and eventually becomes dominant. Figures 3; tables 4; references: 6 Russian.

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PROPERTIES OF FOURIER TRANSFORMATION OF ANTENNA NEAR FIELD MEASURED ON NON-SPHERICAL SURFACE

Gorkiy IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOFIZIKA in Russian Vol 29, No 2, Feb 86 (manuscript received 13 Jul 84) pp 191-202

[Article by Yu.I. Belov and D.Ye. Yemelyanov, Scientific Research Institute of Radiophysics]

[Abstract] Scanning of the near field of an antenna is considered and an algorithm of Fourier transformation from a nonspherical or spherical scanned surface onto the plane of the antenna aperture is proposed, this algorithm involving essentially resolution into plane waves and focusing of the near field from a surface segment onto a point in the antenna aperture. The method of such a resolution is applicable when the scanned surface is not a plane, the derivative at a sharp bend on the surface is finite, and the surface is at least several wavelengths away from the antenna aperture. The amplitude-phase distribution calculated according to this algorithm depends largely on the distance from the "pendulum" pivot to the azimuthal antenna axis. The effect of an aperture edge is of the same order of magnitude as that of a wedge edge along the scanned surface. The authors thank V.I. Turchin and V.S. Korotkov for discussion. Figures 4; references: 7 Russian.

2415/9716
CSO: 1860/215

PROBING OF IONOSPHERE WITH CONTINUOUS LINEAR-FREQUENCY-MODULATED RADIO SIGNALS

Gorkiy IZVESTIYA VYSSHIKH UCHEBNIKH ZAVEDENIY: RADIOFIZIKA in Russian Vol 29, No 2, Feb 86 (manuscript received 23 Jul 85) pp 235-237

[Article by V.A. Ivanov, V.A. Frolov, and V.V. Shumayev, Mari Polytechnic Institute]

[Abstract] In the USSR radio pulse signals with linear frequency modulation are now used for probing the ionosphere. Probing with continuous signals is preferable and Chirp Sounder equipment has been developed for this purpose, but generating a spectrally pure continuous LFM signal on a 10^8 - 10^9 base presents difficulties. A probe operating with continuous radio signals has also been developed at the Mari Polytechnic Institute. It contains LFM radio signal generators, each a synthesizer of multilevel signals, one with a power amplifier on the transmitter side and one acting as heterodyne on the receiver side with a spectrum analyzer and an ionogram plotter. The receiver has a 150 Hz bandwidth and consists of a set of preselector switches, a first mixer with a quartz bandpass filter (128 kHz center frequency, 150 Hz bandwidth), an intermediate-frequency amplifier, a second mixer with a low-pass filter, and a low-frequency amplifier. In the receiver takes place frequency compression of the LFM signal from the transmitter. The spectrum analyzer is a low-frequency parallel one with 200 channels for analysis of 200 Hz bands. The probe was assembled in early 1985 and tested during April-May of that year on the proving ground at the Scientific Research Institute of Radiophysics in Gorkiy. The authors thank L.M. Yerukhimov for interest and L.V. Grishkevich for providing data on pulse probing of the ionosphere. Figures 4; references 8: 6 Russian, 2 Western (1 in Russian translation).

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AMPLITUDE FLUCTUATIONS OF COLLIMATED GAUSSIAN BEAM OF MILLIMETRIC RADIO WAVES ALONG LINES OF ABSORPTION BY ATMOSPHERIC OXYGEN

Gorkiy IZVESTIYA VYSSHIKH UCHEBNIKH ZAVEDENIY: RADIOFIZIKA in Russian Vol 29, No 2, Feb 86 (manuscript received after revision 15 Jul 85) pp 237-240

[Article by R.I. Kurbatova, I.M. Fuks, and L.I. Sharapov, Institute of Radiophysics and Electronics, UkSSR Academy of Sciences]

[Abstract] Amplitude fluctuations of a collimated Gaussian beam of millimetric radio waves along lines of absorption by oxygen in the surface layer of the atmosphere are analyzed in the approximation of a plane phase front in the plane of the transmitter aperture and weak attenuation along the path. Calculations are based on the first approximation to the method of smooth perturbations. Numerical results for two wavelengths, 5 mm and 2.53 mm, over

550-1700 m long paths are compared with experimental data. The agreement is found to improve with inclusion of the statistical dispersion of fluctuations. The absorption component of amplitude fluctuations depends on the temperature derivative of the absorption coefficient and on the ratio squared of this derivative to the temperature derivative of the refractive index. Figures 2; tables 1; references 9: 8 Russian, 1 Western.

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SURFACE VERY LOW FREQUENCY ANTENNAS ON RAISED ELEVATIONS

Moscow RADIOTEKHNIKA in Russian No 3, Mar 86 (manuscript received 17 Sep 85)
pp 15-19

[Article by Yu.A. Korchagin and I.P. Rozmanov]

[Abstract] One of the means of increasing the amplification of surface antennas is the use of a raised elevation as a composite element. Models were investigated of elevations in the form of a conductive semi-cylinder and a conductive hemisphere. Experimental measurements were made of the fields and the effective heights of very-low frequency (3 - 30 kHz) antennas with various configurations on elevations. Figures 4; references 6: 5 Russian, 1 Western.

6415/9716
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EFFECT OF ATTENUATION ON OPERATION OF ACOUSTOOPTICAL SYSTEMS FOR PROCESSING SIGNALS OF LINEAR PHASED ARRAY

Moscow RADIOTEKHNIKA in Russian No 3, Mar 86 (manuscript received 14 Aug 85)
pp 65-68

[Article by Yu.G. Vasilyev]

[Abstract] Two methods are considered for processing the signals of a linear phased array (LPA) with the aid of acoustooptics: 1) A method of spatial multichannelling realized with the aid of a multichannel acoustooptical modulator (AOM); and 2) A method based on time diversity of the signals. The analysis conducted showed that in a multichannel system acoustic attenuation affects processing of LPA resolution signals with respect to the angular coordinate, as is the case in an acoustooptical system with time diversity of signals from the LPA elements where attenuation exerts a significant effect on the angular resolution. Figures 3; references 10: 8 Russian, 2 Western (1 in Russian translation).

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SPECIAL FEATURE OF CALCULATION OF SURFACE WAVE PROPAGATION CONSTANT ALONG INSULATED CONDUCTOR IN CONDUCTING MEDIUM

Moscow RADIOTEKHNIKA in Russian No 3, Mar 86 (manuscript received 8 Oct 85) pp 77-79

[Article by C.K. Lipskiy]

[Abstract] The presence of insulation on a metallic conductor with good conduction properties creates conditions for propagation along it of surface waves which possess a comparatively small attenuation. Detailed mathematical recommendations are presented with respect to calculation of such propagation. Figures 1; references 3: 2 Russian, 1 Western.

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DETECTION OF QUASIPERIODIC STRUCTURE IN IONOSPHERE BY DATA CONCERNING SCINTILLATIONS OF RADIO SOURCES

Moscow RADIOTEKHNIKA in Russian No 3, Mar 86 (article received 18 July 1985) pp 82-84

[Article by I.T. Bubukin]

[Abstract] Data are cited concerning the structure of ionosphere inhomogeneities. Radiographic inspection of the earth's atmosphere with the aid of cosmic radio sources makes it possible to obtain valuable information concerning its characteristics. Analysis of the diffraction pattern of a wave passing through the ionosphere or troposphere of the earth lies at the base of the method. Observations are described conducted on an antenna simultaneously at two frequencies: 178 MHz and 2.960 MHz. During the period of observation the height of the sources above the horizon was from 10° to 41°. Observations were made after midnight over the course of 3 hours. Three sessions of observation were made of the source Cassiopeia A with continuous recording of the source's radiation for 3...4 minutes, and one session of observation of the source Taurus A with a duration of approximately 10 minutes. A table presents the values of the indices of scintillation at the two frequencies, the parameter of the frequency independence, and the correlation coefficient of the signal. Comments are made concerning these data. Figures 1; references 5: 4 Russian, 1 Western.

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STATISTICAL CHARACTERISTICS OF THE AMPLITUDES OF ROUND-THE-WORLD SIGNALS

Moscow RADIOTEKHNIKA in Russian No 3, Mar 86 (manuscript received 8 July 85) pp 84-88

[Article by N.V. Bakhmatyeva, Ye.A. Benediktov, Yu. K. Goltsova, and Yu.A. Ignatyev]

[Abstract] Data are presented concerned with the statistical characteristics of the amplitude of round-the-world signals (RWS), including space-time signals, at 21-23 MHz frequencies, obtained during years with various solar activities. Differences in the results of various years are noted. A comparison is made of the statistics of RWS with the characteristics of oblique sending signals. The experiments conducted established: 1) The statistical regularities of round-the-world signal amplitudes A_{RWS} during various observation periods are described in the fundamental Nakagami-Rice distributions and the logarithmic-normal. On the average the time interval for correlation of A_{RWS} amounted to 0.16...0.44 second with low dispersion. In a number of cases the spatial correlation function has a nonmonotonic nature, more pronounced with longitudinal separation of the receiving antennas. An evaluation of the input angles in the vertical plane made with the use of data from the longitudinal and transverse correlation gave a magnitude of 15...20°. Figures 4; references 17: 13 Russian, 4 Western.

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ELECTRODYNAMIC ANALYSIS OF TWO-WIRE CIRCUIT LOADED WITH A SYSTEM OF DIPOLES

Moscow RADIOTEKHNIKA in Russian No 3, Mar 86 (manuscript received 6 Sep 85) pp 89-90

[Article by V.P. Kudin]

[Abstract] A method based on integral equations was developed for an electrodynamic analysis of a two-wire circuit loaded with a system of dipoles. This method uses the approach developed in the 1964 book "Super Wide-band Antennas" by R. Karrel, which is described but also takes into account the in-phase currents in the line. Figures 3; references 3: 2 Russian, 3 Western (2 in Russian translation).

6415/9716
CSO: 1860/243

ANALYSIS OF SCANNING MULTIFREQUENCY COMBINED DIPOLE ANTENNA ARRAYS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 31, No 2, Feb 86
(manuscript received 13 Aug 84) pp 241-248

[Article by A.S. Ilinskiy, L.I. Ponomarev, L.V. Gordiyenko, and A.V. Shamalov]

[Abstract] An analysis was made of scanning multifrequency combined dipole antenna arrays (DAA), i.e., a combination of several DAA placed in one radiation aperture and operating in various frequency ranges. Such antenna arrays enable independent scanning by beam in several frequency bands and to solution of the problem of integrating multipurpose antenna devices of various radio systems. A numerical analysis performed using the example of a two-frequency DAA showed that combination leads to a reduction of the amplification coefficient and the sector scanning of the multifrequency combined diode antenna array, as well as to the appearance of specific side lobes particularly strongly displayed in the high-frequency band. In the low-frequency band the negative phenomenon of coincidence is expressed more weakly. Figures 5; references 7: 6 Russian, 1 Western.

6415/9716
CSO: 1860/241

UDC 537.876.23:551.510.5

ON A METHOD OF MEASURING THE VERTICAL ABSORPTION OF AN UNCONTAMINATED ATMOSPHERE AT 0.8 AND 1.35 CM WAVELENGTHS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 31, No 2, Feb 86 (manuscript received 6 June 84) pp 279-285

[Article by V.V. Khrulev]

[Abstract] A method was considered of measuring the total vertical absorption τ_0 of the maritime atmosphere, using a highly directional (pencil beam) antenna at 0.8 and 1.35 cm wavelengths for evaluation of the influence of secondary effects, thus making it possible without enlistment of aerological sounding data to measure τ_0 with higher precision. Experimental results demonstrated that in practice the method makes it possible to provide a relative error of measurement $\delta \tau_0 < 5\%$ with $\tau_0 > 0.1$ and $\Delta \theta_{0.5} \sim 1.5^\circ$ with an easily attainable sensitivity of the radiometric equipment ($\Delta T_\phi \sim 0.1$ K with 16 second time constant). Figures 5, references: 9 Russian.

6415/9716
CSO: 1860/241

EFFECT OF PARASITIC RADIATION OF SOLAR SPACE ELECTRIC POWER STATION ON THE ELECTROMAGNETIC CONDITION IN THE FRONT HEMISPHERE

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 31, No 2, Feb 86 (manuscript received 3 Aug 84) pp 370-375

[Article by A.S. Dmitriyev and B.M. Paramonov]

[Abstract] One of the problems which arise during the creation of solar space electric power stations (SPEPS) with energy transmission in the microwave band is to assure electromagnetic compatibility with terrestrial radio-electronic systems, as well as with analogous systems located on board the space apparatuses. This article studies some causes for the negative effect of SPEPS on the electromagnetic compatibility. It is concerned with the processes of generation and radiation of microwave energy in the transmission system and an evaluation of the "electromagnetic purity" strictly of the SPEPS. The following items are studied in detail: 1) Model of microwave system. Mechanisms for origin of parasitic radiation; 2) Directional properties of system at near basic frequencies; 3) Directional properties of radiation at basic frequency with partial loss of correlation between amplitudes of signals, and 4) Directional properties of radiation at harmonics of basic frequency. A simple model is selected which makes it possible to judge the contribution of various factors to the electromagnetic condition and makes it possible quantitatively to evaluate the maximum permissible distortions of the standard signal. The results obtained have an estimation nature and require a more exact definition: in particular to obtain a more precise evaluation calculation of the mutual effect of the system elements and the properties of the amplifiers used. Figures 6; references 5: 2 Russian, 3 Western.

6415/9716

CSO: 1860/241

PROTECTION OF CONSUMER RADIO EQUIPMENT AGAINST MOISTURE

Moscow RADIO in Russian No 1, Jan 86 pp 36-38

[Article by O. Yashchenko, Balashikha (Moscow Oblast)]

[Abstract] Radio and television equipment in the home is all year round exposed to moisture, especially when located near a window close to the outside air in winter or next to an air-conditioner in summer. Protection against moisture is needed to avoid degrading the electrical insulation, buildup of stray shunting paths and galvanic connections and corrosion of contactors and soldered joints. Such a protection can be passive or active. Passive means are barrier coatings, antipenetrant impregnation, and hermetic sealing from humid air. Hermetic sealing is most effective, but uneconomical in terms of material and installation cost as well as size and weight disadvantages to which poor repairability must be added. Molding with plastics and impregnation with polymer compounds ensures durable protection, but requires careful and reliable insulation of lead wires. Most preferred so far are varnish coatings, epoxy resin being the best moisture-resistant material for this application. Polystyrene is a poor protective material under adverse conditions but, unlike all others, recovers its properties upon return to normal conditions. Active protection is provided by absorbers which extract moisture from the air inside the case, granular glassy silica gel being the most widely used and least costly material. It is available in microporosity grades (KSMG, ShSMG) and in macroporosity grades (KSKG, ShSKG, MSKG, ASKG). It should be placed under the top of the case so that the heavier dry air will flow down while the lighter moist air flows up. In tube sets the absorbent can be recovered by drying with the heat from the tubes, such a drier operating as a pump. For transistor sets such a drier consists of a steel or brass mesh with 1 mm² large holes attached to the case and heater coils wound on porcelain sleeves, a pressure-sensitive microswitch turning this heater on or off depending on the weight of the silica gel. Figures 2.

2415/9716

CSO: 1860/205

RELAYING AUDIO PROGRAMS OVER INFRARED BEAMS

Moscow RADIO in Russian No 1, Jan 86 pp 27-29

[Article by V. Gushchin and I. Fostyak, Lvov]

[Abstract] Relaying audio programs to earphones over infrared beams is proposed, for added versatility and convenience. Programs from diverse sources of low-frequency signals ranging in amplitude from 5 mV to 30 V can be transmitted wirelessly over infrared beams generated for this purpose by a light-emitting diode, this method ensuring a stable reception no matter how source and listener are positioned relative to each other. Implementation of this method requires a transmitter, a receiver, and earphones. The transmitter includes an audio-frequency amplifier on four transistors with automatic gain control, a frequency modulator, a power amplifier, a light-emitting diode, and a power supply. The modulator is a voltage-controlled generator of square pulses, their initial repetition rate in the absence of an audio-frequency voltage being set at 95 kHz by means of an adjustable resistor. Frequency-modulated signals enter the power amplifier, which is loaded by the light-emitting diode. When programs are relayed only from one source such as a particular television set, then the automatic gain control can be eliminated. The receiver includes a light-activated diode, an amplifier-limiter on three transistors with overcompensation on the high-frequency side (125 kHz) of the amplitude-frequency characteristic, a frequency detector with automatic phase-lock frequency control for higher sensitivity, and a power amplifier loaded by the two dynamic heads in the earphones. The receiver components are mounted in the right earphone, the power supply transformer wound on a ShL12x12.5 core is mounted in the left earphone, and the transmitter is mounted in a separate attachment. Alignment and tuning begin with the transmitter. The earphones perform well in any position, but best when the light-activated diode in the receiver is oriented toward the light-emitting diode in the transmitter. Each diode should be protected with a heat dissipator-reflector. Figures 4.

2415/9716

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UDC 621.397.13:778.1

METHODS OF GENERATING PSEUDOSTERFOSCOPIC TELEVISION IMAGES

Moscow TEKNIKA KINO I TELEVIDENIYA in Russian No 3, Mar 86 pp 29-32

[Article by P.M. Kopylov, O.V. Ukrainskiy and V.V. Rybakov, Leningrad Electrical Engineering Institute for Communications imeni M.A. Bonch-Bruyevich]

[Abstract] An artificial stereo pair can be produced in a TV system by means of shifting the separate chrominance images and viewing them separately through color glasses with the left and right eyes. Of the pairs of colors available for image separation, yellow and blue are chosen because of difficulties in use of other pairs while the blue beam is easily shifted in a TV circuit. This approach is applied to stereo pair reproduction with the standardized ULPTsT-P television receiver. The specific circuit changes required are

indicated; these changes allow for a variable parallax over the image field. Two methods are possible: parallax can vary linearly along the horizontal to produce the stereo effect; the degree of this change depends on the true spatial arrangement of the imaged objects. The dynamic variation of the parallax in the direction of the vertical sweep also provides a significant stereoscopic effect, since the change is statistically well-correlated with the image structure for the majority of pictures. This method is preferable, although image fragments extending a considerable distance horizontally are skewed slightly in this case. The experimental observation of TV programs on a modified color set confirmed the viability and superiority of the latter approach. Figures 3; references 5: 4 Russian, 1 Western.

8225/9716
CSO: 1860/234

UDC 621.397.61

NEW TELEVISION BROADCAST CAMERA SYSTEM

Moscow TEKNIKA KINO I TELEVIDENIYA in Russian No 3, Mar 86 pp 4-11

[Article by V.V. Odnolko, All-Union Scientific Research Institute for Television]

[Abstract] The new generation KD-1 camera system consists of the KT-178 TV camera and the S-1671 camera circuit and power supply rack, developed by the All-Union Scientific Research Institute for Television. All of the major functions (video signal processing, synchronization, remote and automatic control and the power supply) are distributed between the KT-178 camera and the BKK-1062 camera support circuit incorporated in the S-1671. The optical head of the KT-178 uses a prism beam splitter assembly with three 20 mm camera tubes (Soviet LI-434, LI-485 or LI-457, LI-458, which are interchangeable with the XQ2070 plumbicon). The BKK-1062 camera circuit generates the R, G and B signals plus a composite SECAM chrominance signal, or the brightness Y and chrominance difference R-Y and B-Y signals for digital studios. The block diagram of the system is explained and supplemented with photographs of both the KT-178 camera itself and S-1671 rack. Nominal operation of the KT-178 requires an illumination of no more than 800 lux with an objective aperture ratio of 1:2.8; good image quality is preserved at around 200 lux. The nominal camera resolution is 600 lines in the center and 500 in the corners of the image. The Y signal/noise ratio at the camera circuit output is 52 d B. Crosshatch distortion of the camera tube rasters is no more than 1% over the entire image field. The KT-178 camera is 525 mm long (without the objective or viewfinder), 280 mm wide, 350 mm high and weighs 32.8 kg. When used with a mobile studio, the camera can be up to 1,000 m from the camera circuit rack. A prototype of the KD-1 camera system was tested at the Minsk Republic Radio and Television Center; technicians rated its performance as comparable to its best foreign counterparts, in particular, the TTV-1515 made by Thomson CSF. The article also details the operation of the remote control systems and notes that the KD-1 will be produced by the Volna Novgorod Scientific Production Association. Figures 4.

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RELIABILITY OF TELEVISION RADIO STATION HAS INCREASED

Moscow VESTNIK SVYAZI in Russian No 4, Apr 86 pp 31-32

[Article by A.G. Volkov, chief specialist, and E.A. Lyudva, senior engineer, production laboratory, All-Union Radio Television Transmitting Station]

[Abstract] Several design changes have been made in IGLA and ZONA equipment which will reduce destabilizing effects in the high-frequency channel of the Len third-band radio transmitter. They affect mainly the oscillator-modulator stages and the feedback loop. The feedback signal comes now from one terminal set rather than from the output. In the feedback loop around the detector bank and the modulator are now included repeater stages on transistors with a high modulation factor to suppress interference from strobing and quench clamping circuits. The diode in that loop has been removed to shorten the transient starting period and to avoid distortion of the feedback signal as a result of subcarrier elimination. A protective circuit has been added to prevent wide opening of the transistor in the modulated stage and thus ensure an adequately large high-frequency output signal. The diodes in the oscillator-modulator channel are shunted by capacitors to suppress noise, but a pair of transistors in parallel is tied to the second diode so as to ensure an exponential rise of the supply voltage from 0 to +11 V, without dangerous peaking, across the last three modulator stages. The modulator amplitude-frequency characteristic is corrected by means of an LC filter circuit behind a limiting series resistor at the output, which compensates the dip within the 6 MHz range caused by the ultrahigh-frequency signal. Arcing in the high-frequency switches during commutation of transmitters, which causes burning of the contactors, is eliminated by decreasing the capacitance of the RC filter in the frequency-multiplier stage without degradation of the performance. Automatic gain control is recommended for stabilizing the sound track oscillator-modulator stage. These modifications have significantly improved the performance of a Len radio station, replacement of 105 electron tubes with transistors having already contributed to a much higher reliability and reduced the internal power consumption by approximately 3 kW. Elimination of 22 components requiring operational control has also made maintenance much simpler. Figures 5; tables 1.

2415/9716

CSO: 1860/266

PROSPECTS FOR IMPROVEMENT OF ELECTRIC POWER SUPPLIES FOR MOTION PICTURE PROJECTOR XENON LAMPS

Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 12, Dec 85 pp 6-9

[Article by V.S. Danilov, V.V. Zaitsev, G.M. Klushin, M.L. Ryabokon and B.Z. Yudovskiy, All-Union Cinematographic Scientific Research Institute]

[Abstract] The VKT power supplies for xenon projector lamps began to be produced in the 1980s. The output current control and stabilization circuit of the VKT power supply is a semiconductor device, which greatly improves efficiency and specific power output, while significantly improving quality, decreasing pulsation and improving stabilization and optimizing the dynamics of the process of the ignition of the xenon lamp. Laboratory models have now been developed of new power supplies with transistorized and thyristor converters. The dynamics of improvement of power supplies have until now been evaluated based on individual technical characteristics. This is inconvenient and insufficiently objective, since technical requirements are frequently contradictory. It would be most convenient to evaluate power supplies based on summary effectiveness criteria reflecting the degree to which a product meets its designed purpose. However, there are as yet no mathematical expressions for the criterion of effectiveness of power supplies for motion picture projection equipment. The authors suggest such a criterion, and request that workers in the industry suggest improvements to the criterion, which can be used to develop future, improved power supplies. References: 7 Russian.

6508/9716
CSO: 1860/200

UDC: 621.397.611 BM

THE CURRENT STATUS AND PROSPECTS FOR DEVELOPMENT OF HOME MAGNETIC VIDEO RECORDERS

Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 12, Dec 85 pp 26-30

[Article by I.A. Slutskiy and B.Ya. Smirnov]

[Abstract] The Elektronika VM-12 VHS VCR is described as representing the current state of the art in Soviet home video tape recording. For the future, a transition from analog to digital recording could allow straight-line (rather than slanted frame row) recording of video signals on magnetic tape moving at reasonable speeds with significantly improved band width and 25% redundancy for error correction. Second generation digital video recorders would also be well suited for data recording for use with home computers. These future longitudinal, multichannel recorders will utilize microcomputer controlled digital elements, achieving high quality with small numbers of moving parts. Figures 4, references: 9 Russian.

6508/9716
CSO: 1860/200

ELECTRONIC SOUND SIGNAL SWITCH

Moscow TEKNIKA KINO I TELEVIDENIYA in Russian No 12, Dec 85 pp 31-32

[Article by O.I. Gichko and N.A. Shevchenko]

[Abstract] An electronic sound signal switch is described, intended for switching of 80 input unbalanced 2-channel audio frequency signals to 10 unbalanced 2-channel outputs. Using a 2-stage structure, the new switch improves crosstalk attenuation and eliminates false operation of the switch resulting from pulse noise in the control channel. The technical characteristics of the device are presented, as well as structural diagrams of the switching unit. A set of these switches can be used to construct an 80 x 120 switching field controlled by parallel binary-coded decimal code with time-division multiplexing utilizing an automated, microprocessor-based control system. Figures 4, references: 2 Russian.

6508/9716

CSO: 1860/200

UDC: 681.84:621.3.037.372

DIGITAL RESTORATION OF PHONODOCUMENTS BY COMPUTER

Moscow TEKNIKA KINO I TELEVIDENIYA in Russian No 1, Jan 86 pp 7-11

[Article by A.V. Chichagov, Scientific Research Center of Technical Documentation of the USSR]

[Abstract] The task of restoration of phonodocuments (sound recordings) is to eliminate defects in the sound recording which have arisen in manufacture, storage or use and to improve the sound quality of the phonograms. Traditional methods of restoration of phonodocuments have a number of shortcomings, making the development of new and more effective methods of phonodocument restoration particularly significant. Digital, computerized sound processing methods have become more common in recent years. These methods include three major stages: conversion of the analog sound signal to a digital signal which is stored in computer memory; mathematical processing of the digital information; output of the processed digital information as an analog sound signal. The algorithms of programs for elimination of a number of sound recording defects available at the author's institute are briefly described. Processes utilized include digital filtration, pulse noise suppression and suppression of noise in sound signal pauses. References 11: 10 Russian, 1 Western.

6508/9716

CSO: 1860/203

A SPECIALIZED SYSTEM FOR DIGITAL PROCESSING OF AUDIO SIGNALS

Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 1, Jan 86 pp 16-20

[Article by Yu.N. Baryshnenkov, All-Union Cinematographic Scientific Research Institute]

[Abstract] Various methods of digital processing of sound signals are under development in the USSR and abroad. The use of digital equipment allows the creation of instruments with basically new fundamental capabilities satisfying the constantly increasing demands for creative work in cinematography. Due to economic considerations, it is desirable to construct digital sound systems from sets to standard modular equipment rather than designing specialized devices for each application. This article describes the results of studies of the possibilities of constructing specialized systems of modular standard devices. The analysis presented defines the principles of constructing specialized digital processing systems for real-time operation using standard devices. Figures 4, references 9: 4 Russian, 5 Western.

6508/9716
CSO: 1860/203

UDC: 681.84:621.3.037.372

MAJOR PROBLEMS OF CREATION OF HIGH RESOLUTION TELEVISION

Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 1, Jan 86 pp 21-24

[Article by S.V. Novakovskiy, A.V. Kotelnikov, A.A. Maksakov and V.N. Bezrukov, Moscow Electric Engineering Institute of Communications]

[Abstract] It will be possible in the near future to improve television picture quality greatly by increasing its resolution, as well as changing the aspect ratio to something more like the broader screens used in contemporary motion pictures. The transition to higher resolution pictures (more lines per inch) must be made gradually, while retaining compatibility with existing television sets. Doubling of the number of lines in the television image, in combination with a change to an aspect ratio of 5/3 or 2/1, will result in excellent image quality on future 1 meter television screens. The broader images have been found to result in noticeable image flickering at the edges, which can be eliminated by higher frame speeds, perhaps artificially generated within the TV sets to allow the broadcast signal to continue to use the present number of frames per second. Digital encoding and compression of present-day analog signals could achieve much more efficient television transmission than the present system.

6508/9716
CSO: 1860/203

UDC: 621.3.038:681.14

AUTOMATED FORMATION OF RIGIDITY MATRIX OF STRUCTURES IN SYSTEMS FOR AUTOMATED DESIGN OF VIBRATION-RESISTANT RADIO APPARATUS

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian
Vol 28, No 3, Mar 86 (manuscript received 21 Jan 85) pp 22-27

[Article by A.M. Tartakovskiy and Ye.N. Makvetsov]

[Abstract] One of the most difficult problems arising in the development of vibration-resistant electronic hardware is automated construction of a model of the structure required, a mathematical description in the form of a set of algebraic equations. Formalization and algorithmization of this procedure allow automation of the process of design of a rigidity matrix, thus significantly reducing the time required to prepare initial data for modelling and avoiding errors which cannot be avoided when data are manually prepared. The model developed in this article is a system of concentrated mass nodes connected by non-inertial elastic couplings. Displacement functions are approximated by exponential polynomials. Figures 3, references: 4 Russian.

6508/9716
CSO: 1860/232

UDC: 656.25:621.315:621.317

DEVICE FOR AUTOMATIC SWITCHING OF INTERFERING CIRCUITS DURING BALANCING OF CABLES

Moscow AVTOMATIKA, TELEMEXHANIKA I SVYAZ in Russian No 3, Mar 86, pp 29-31

[Article by F.P. Mikulik, assistant professor, All-Union Correspondence Institute of Railroad Transport Engineering, A.I. Kurilo, Chief of Technical Department, Transsvyazstroy Trust, and V.S. Yarotskiy, Laboratory Chief, Transsvyazstroy Trust]

[Abstract] Cables are balanced manually at present by measuring cross-talk at the near end and interference protection at the far end with the VIZ-600 visual attenuation measuring equipment. The authors of this article have developed a device for automatic switching of circuits which are interfering with each other based on the use of relay switches at the transmitting and receiving ends of the line. High speed type RES neutral relays are used, allowing switching of the circuits during pauses between frequency modulated signal samples produced by the VIZ generator. The maximum time to switch interfering circuits is not over 30 ms, less than one-sixth the time of pauses between signal samples produced by the VIZ generator. Automatic switching of interfering circuits reduced the time required to balance any cable in one amplifier sector by more than 5 hours, or an average of 15%. The productivity of labor is increased by 20%. Figures 4.

6508/9716

CSO: 1860/238

OPERATIONAL REPAIR RADIO COMMUNICATIONS IN RAIL TRANSPORT SYSTEM

Moscow AVTOMATIKA, TELEMEXHANIKA I SVYAZ in Russian No 3, Mar 86 pp 15-20

[Article by Yu.V. Vavanov, Department Chief, All-Union Scientific Research Institute of Rail Transport, Candidate of Technical Sciences, N.Kh. Dagayeva, Deputy Department Chief, and N.Ye. Dotsenko, Chief, Department of Radio Communications, Main Administration of Signals and Communications, Railroad Ministry]

[Abstract] The organization of radio communications with track repair crews is outlined. The communications network includes the repair leader and track machine technicians, signal operators, dispatchers, station duty officers and locomotive engineers. Large tables illustrate the hierarchy of interconnections in the communications network. Radio sets used include the RN, RV and RS series.

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CSO: 1860/238

UDC: 636.259.1:254.16

OPERATION OF RADIO CONTROLLED RAILWAY SWITCHES AND BYPASSES

Moscow AVTOMATIKA, TELEMEXHANIKA I SVYAZ in Russian No 3, Mar 86 pp 27-29

[Article by Yu.V. Sharfenberg, Sr. Engineer, Main Administration of Commercial Railroad Transport, Roadroad Ministry and B.N. Pichugin, Sr. Electromechanic, Klinsk Commercial Railroad Transport Organization]

[Abstract] One quarter or more of the time of maneuvering of trains as they are made up may be involved in walking along tracks and manually switching track switches. Seven years experience in this area by the authors' organizations has indicated that it is most desirable to let the makeup team itself select the optimal path of movement of the trains as they are being made up with switches controlled by radio from the cabin of the locomotive. This article discusses the experience of these organizations in developing and using radio controlled switches and side track bypasses in the Moscow area. Accidental switching due to radio interference is avoided by the use of a 2-signal radio system, the switch not operating unless both signals are received simultaneously. The editors invite other railroad workers to share their experience in the use of radio controlled switches. Figure 1.

6508/9716
CSO: 1860/238

EFFICIENT USE OF COMMUNICATION CHANNELS FOR DATA EXCHANGE BETWEEN COMPUTERS BY BATCH TRANSMISSION

Kiev ELEKTRONNOYE MODELIROVANIYE in Russian Vol 8, No 2, Feb 86 (manuscript received 6 Apr 84, after revision 12 Dec 84) pp 21-25

[Article by Yuriy Viktorovich Bondar, candidate of technical sciences, senior scientific associate of Kiev Institute of Automation imeni 25th CPSU Congress and Igor Anatolyevich Kirillov, candidate of technical sciences, Kiev Institute of Automation imeni 25th CPSU Congress]

[Abstract] A data processing computer network is considered where a message flux entering the computer-sender is stored in it till batches accumulate for sequential transmission to the computer-receiver. The efficiency of batching is evaluated on the basis of a probabilistic model of error-free transmission with exponential distributions. The optimum batching time is determined for communication channels of three different types, the optimality criteria being different in each case. For a multiple-access channel operating on the first come-first serve basis the optimum batching time will minimize the channel duty factor, as it will also for a channel with absolute priority given to urgent messages by allowing them to interrupt transmission of ordinary messages. For a channel with relative priority given to urgent messages by providing a separate subchannel, the optimum batching time will minimize the mean waiting time for ordinary messages to be transmitted. In each case the number of processor interruptions for data input must also be minimized, and the necessary memory volume ensuring minimum probability of overflow during a data exchange cycle will depend on the batching time. References: 7 Russian.

2415/9716
CSO: 1860/206

UDC: 621.391.28

INFORMATION-COMPUTER NETWORKS AND DATA TRANSMISSION NETWORKS

Moscow ELEKTROSVYAZ in Russian No 3, Mar 86 (manuscript received 24 Oct 85) pp 2-7

[Article by V.O. Shvartsman]

[Abstract] A generalized discussion is presented of the 7-layer data-interchange structure suggested in CCITT X.200 and X.210. The functions of the individual layers are explained from top to bottom as outlined in later CCITT documents. The 7-layer model represents a formal description of the interaction of open systems reflecting the interrelationships among physical processes occurring in the system and communications network. The open-system architecture model is suggested for use in the development of new systems. Figures 2, references: 6 Russian.

6508/9716
CSO: 1860/245

9600 BPS DIGITAL SIGNAL CONVERTER FOR VOICE-GRADE CHANNELS

Moscow ELEKTROSVYAZ in Russian No 3, Mar 86 (manuscript received 29 Jan 85)
pp 8-10

[Article by L.N. Afanasev, Ye.D. Kashayev, V.P. Klimin, N.P. Mironov,
N.N. Olshevskiy, G.B. Seleznev, a.v. Starovoytov, B.V. Sultanov and
S.L. Shutov]

[Abstract] Digital signal converters meeting the requirements of CCITT V29 have been developed in the USSR. This article discusses the results of testing of such a device. Amplitude-phase modulation with partial side band suppression is used to generate a single-side band signal which can be transmitted through a channel with a bandwidth of 3 kHz. Test results showed good noise tolerance for data transmission by this method. Figures 4, references: 3 Russian.

6508/9716
CSO: 1860/245

UDC: 621.394.14:681.3.05.534.852.4

CODING METHOD FOR CHANNELS WITH INTERFERENCE BETWEEN SYMBOLS

Moscow ELEKTROSVYAZ in Russian No 3, Mar 86 (manuscript received 2 Nov 84)
pp 15-19

[Article by S.I. Alyabyev and L.V. Muravnik]

[Abstract] Blocked 3-level codes can significantly increase transmission rates, but require synchronization of signals by groups in decoding. Increased transmission rates are limited in most 3-level code schemes by intersymbol interference which can be decreased by effective construction of a coding algorithm. This article describes a new quasi-ternary code with alternating pulse polarity. This method of coding can be used in digital transmission systems to increase digital signal transmission rates while maintaining transmission quality. Figures 4, references: 10 Russian.

6508/9716
CSO: 1860/245

ATR USER TRANSLATOR APPARATUS

Moscow ELEKTROSVYAZ in Russian No 3, Mar 86 pp 20-23

[Article by Yu.S. Tatyatin, A.N. Gaponov and V.A. Bikkard]

[Abstract] User translation apparatus is intended to connect users to an automatic telephone exchange or manual long-distance exchange switches over intercity voice-grade lines without allocation of a signal channel. This article presents photographs, block diagrams and a description of the ATR series of user translators, in which the code signals between translators are transmitted over a voice-grade channel at 2600 Hz. The apparatus has been tested under operating conditions with a signal generator imitating dialing, interconnection and line busy conditions. Figures 7.

6508/9716

CSO: 1860/245

UDC: 621.373-3

FREQUENCY SYNTHESIZER FOR COMMUNICATIONS RADIO TRANSMITTER QUALITY MEASUREMENT APPARATUS

Moscow ELEKTROSVYAZ in Russian No 3, Mar 86 (manuscript received 24 Apr 85) pp 30-32

[Article by V.P. Bylinkin, A.P. Nushtayev and Ye.F. Shmyrev]

[Abstract] An apparatus has been developed and testing for measuring of the quality indicators of radio transmitters for major communications links. The frequency synthesizer used in this device serves as a source for beat frequency voltages for the reverse converter device as well as a source of test measurement signals. The design of the devices is briefly outlined. Laboratory and field tests have confirmed the correctness of the design of the device, showing its operation to be reliable and effective. Figures 4, references: 3 Russian.

6508/9716

CSO: 1860/245

AUTOMATED TESTING OF RECEIVER FREQUENCY CHARACTERISTICS WITHOUT INTERRUPTING COMMUNICATIONS

Moscow ELEKTROSVYAZ in Russian No 3, Mar 86 (manuscript received 28 Jun 85)
pp 36-39

[Article by K.N. Martyshevskiy and V.P. Mushkov]

[Abstract] This article discusses the problem of testing the frequency characteristics of low-noise satellite communications receivers without interrupting communications. A system has been developed for monitoring the AFC (Automatic frequency control) of communications channels which monitors the variation in gain as a function of frequency by decreasing the time and discretization step of measurement of the gain over a broad frequency band. Operation of the device is described. The use of the system can significantly reduce the time required to measure the gain over a broad frequency band, eliminating the discrete nature of the points monitored, automatically eliminating the possibility that a test signal will be transmitted over working communications channels as their frequency is changed. Figures 3, references 5: 3 Russian, 2 Western.

6508/9716
CSO: 1860/245

UDC: 621.389

NEW TYPES OF OPTRONS FOR RADIO HARDWARE

Moscow ELEKTROSVYAZ in Russian No 3, Mar 86 (manuscript received 28 Feb 85)
pp 44-45

[Article by Yu.R. Nosov]

[Abstract] Some of the most interesting new types of optical-electronic devices or optrons are briefly discussed. They include the AOD129A diode optron, the KOD301A differential optron which uses a GaAs radiator and two identical silicon pin LED's, the KOL201A diode-transistor optron and a series of 2-channel optrons including the AOD1348S diode optron and the AOT101ASBS transistor optron. References: 9 Russian.

6508/9716
CSO: 1860/245

SHORT-TERM RADIO WAVE ATTENUATION STATISTICS IN RAIN

Moscow ELEKTROSVYAZ in Russian No 3, Mar 86 (manuscript received 4 Jan 85)
pp 56-59

[Article by Ye.A. Larin]

[Abstract] Experiments on attenuation of radio waves in rain over line-of-sight communications links and satellite links generally determine the empirical distribution function of attenuation. The confidence area of the distribution developed and maximum time necessary to produce a steady distribution are usually not determined. This article attempts to answer these and other related questions as applicable to the attenuation of radio waves in rain. Experimental data are used to obtain universal relationships determining the statistical parameters of the duration of attenuation of radio waves in rain, universal in that they are functions of frequency alone. The model suggested in the article can be used primarily to calculate the guaranteed reliability of communications over rather short time intervals. The criteria and method of estimation of duration of measurements allow estimation of the significance of various experimental data on the attenuation of radio waves in rain. Figures 3, references 10: 4 Russian, 6 Western.

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CSO: 1860/245

UDC: 621.317.765.8

DIGITAL NOISE SIGNAL SIMULATOR

Moscow ELEKTROSVYAZ in Russian No 3, Mar 86 (manuscript received 2 Sep 85)
pp 42-43

[Article by Yu.A. Lada and D.I. Malinovskiy]

[Abstract] Previously known analog noise generators have high temperature instability of noise signal parameters, the noise spectrum shape varies as a function of power supply voltage and the devices are difficult to tune. This article reports a new digital noise signal imitator which does not have these shortcomings. It consists of a clock operating at 70 MHz, a 15-bit shift register and a modulo-2 adder, phase keyer and band-pass filter. The device generates pseudorandom sequences of maximum length, the spectrum of which is shifted to the 70 MHz intermediate frequency by means of a phase modulator based on an XOR logic element. The device consumes 2.5 watts in comparison to the 70 watt power consumption of the standard GS-32 noise generator, and is also smaller and lighter. Figures 3, references 6: 2 Russian, 4 Western.

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CSO: 1860/245

CHARACTERISTICS OF ADAPTIVE NOISE CORRELATION INTERVAL METER

Leningrad IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: PRIBOROSTROYENIYE
in Russian Vol 28, No 12, Dec 85 (manuscript received 25 Feb 85) pp 3-6

[Article by V.V. Shirokov, Leningrad Electrotechnical Institute imeni
V.I. Ulyanov (Lenin)]

[Abstract] A study is made of the relationship between the error of a sign correlation interval meter employed in a communications channel and the probability of occurrence of errors in the sign statistic. An estimate is made of the rate of convergence of the adaptation algorithm, which influences the correlation interval measurement time if the range of possible values is not known a priori. The estimates derived for the error in convergence time are useful for designing adaptive telemetry systems. The function $\vartheta(p)$ makes it possible, for a given error σ , to determine the acceptable reception error probability p , and thus to select the type of keying, the detection method, and the signal power. Figures 1, references 5: 4 Russian, 1 Western.

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UDC 621.396

INCREASING INTERFERENCE IMMUNITY OF RECEPTION OF SHORT-WAVE SIGNALS UNDER CONDITIONS OF FADING

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian
Vol 29, No 4, Apr 86 (manuscript received 23 Nov 84) pp 89-91

[Article by R.G. Tolparev and E.V. Borisov]

[Abstract] Logic detection of interference structurally similar to the useful signal is applied to short-wave signals, which are particularly prone to fading, for the purpose of increasing the interference immunity of their reception. The improved receiver includes then, in addition to two input filters and a decision device, also two threshold devices and an AND gate which generates a request for repeat signal when the output signals from both filters drop simultaneously below some low cancellation threshold. The interference immunity of such a receiver is estimated in terms of the average risk equal to the weighted sum of two penalties, penalty for wrong decision and penalty for no decision, each multiplied by a double definite integral of the product of conditional signal and noise (random quantities) distribution densities with different limits appropriate for each. Calculation of that average risk as a function of the cancellation threshold for various ratios of average signal power to average noise power reveals that for every ratio there is an optimum threshold level which minimizes the average risk. The effectiveness of this system with cancellation increases as the noise power increases. The average risk is decreased by setting the cancellation threshold at optimum level, but the cost is retransmission of unreliably received signals. Figures 2; references: 2 Russian.

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CSO: 1860/264

PULSE-CODE SEQUENCE GENERATOR FOR FIBER OPTIC COMMUNICATIONS LINKS IN THE BAND UP TO 160 MEGAHERTZ

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 28, No 3, Mar 86 (manuscript received after revision 8 Aug 85) pp 96-97

[Article by S.A. Gudoshnikov, A.S. Logginov, K.Ya. Senatorov and B.Yu. Terletskiy]

[Abstract] A simple pumping current generator has been developed to study the specifics of pulse-code modulation of the radiation of an injection laser. The generator forms trains of pulses at pulse repetition frequencies of up to 160 MHz. The number of pulses per train and repetition frequency of trains can be established as required by experiments. The generator consists of a PCM sequence shaper and current switch to increase the currents in a pulse to the value necessary for operation of the injection laser. A schematic diagram of the device is presented, plus tracings of pulses produced. Figures 2, references: 1 Russian.

6508/9716

CSO: 1860/232

INTRODUCTION OF ELECTRONIC SWITCHING EXCHANGES INTO EXISTING NETWORKS

Moscow ELEKTROSVYAZ in Russian No 4, Apr 86 (manuscript received 22 Dec 85) pp 17-24

[Article by V.I. Glinka and Yu.I. Yemelyanov]

[Abstract] The 12th Five-Year Plan will be characterized by the active introduction into municipal telephone networks (GTS) of contemporary switching technology--electronic switching exchanges (ATSE). One of the methods for introducing ATSE into existing GTS, the most efficient method today, and the means for its realization for concrete conditions are considered. Discussion of this problem in ELEKTROSVYAZ and the statements of specialists with respect to refinement of the questions posed in the article make it possible to select the most correct strategy for introducing ATSE into actual networks. Figures 7; references: 4 Russian.

6415/9716

CSO: 1860/262

ENGINEERING ESTIMATE OF CAPACITY OF MICROPROCESSOR IDENTIFIER OF INPUTS TO SWITCHING POINT

Moscow ELEKTROSVYAZ in Russian No 4, Apr 86 (manuscript received 14 Jan 85)
pp 27-29

[Article by B.S. Goldshteyn]

[Abstract] The principal functions of peripheral control devices based on the resources of microprocessor techniques, widely used in contemporary electronic switching points, are the periodic scanning of subscriber lines and junction circuits, and identification of corresponding control and interaction signals by the results of scanning. The analytical model presented (in the form of a simplified block diagram) of such a peripheral microprocessor control device makes it possible to obtain estimates which have a significant effect as a whole on the architecture of the control system of a switching point. Figures 3; references 3: 2 Russian, 1 Western.

6415/9716
CSO: 1860/262

EFFECT OF FLUCTUATIONS ORIGINATING AT RADIATION INPUT ON NOISE IN OPTICAL CABLE COMMUNICATION SYSTEMS

Moscow ELEKTROSVYAZ in Russian No 4, Apr 86 (manuscript received 24 May 85)
pp 39-43

[Article by O.K. Sklyarov]

[Abstract] The results are analyzed of the experimental investigations and measurements conducted at the Central Scientific-Research Institute of Communications with respect to spatial fluctuations of laser radiation and the noise of optical carriers in an optical channel. Figures 8; references 2: 1 Russian, 1 Western.

6415/9716
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OPTICAL RADIATION DISTRIBUTORS OBTAINED BY ABRASIVE METHOD

Moscow ELEKTROSVYAZ in Russian No 4, Apr 86 (manuscript received 18 Feb 85)
pp 43-46

[Article by P.A. Demyanenko, V.D. Nazarov, V.M. Polishchuk and A.G. Tereshchenko]

[Abstract] Methods for realization of optical radiation distributors (ORD) and experimental investigations conducted on ORD are described. The pros and cons peculiar to ORD obtained by the abrasive method are enumerated. The simplicity of fabricating the splitter, not requiring expensive equipment and materials, the simplicity of obtaining the required magnitude of the branching factor with respect to the prescribed thickness of the abraded layer, and the small losses at radiation distribution locations belong to the advantages. The dependence of the shunting factor on the mode composition of the radiation in the input fiber guide, and as a consequence the impossibility of series (cascade) connection of distributors, as well as the difficulty of obtaining more than two outputs of optical realization belong to the disadvantages. Figures 4; references 6: 2 Russian, 4 Western.

6415/9716
CSO: 1860/262

MONOGRAPH ON COMMUNICATION SYSTEMS WITH NOISE-LIKE SIGNALS

Moscow ELEKTROSVYAZ in Russian No 4, Apr 86 p 61

[Article by V.V. Shakhgildyan]

[Abstract] A book by L.Ye. Varakin, "Communication Systems With Noise-Like Signals," Moscow Radio i svyaz, 1985, 384 pages, is reviewed. Basic information is presented concerning noise-like signals (NLS) and the range of their application. Material devoted to electromagnetic compatibility of communication systems which have NLS with narrow-band radio communication is of particular interest. Much attention is devoted to the properties of phase-manipulated signals, and to systems of phase-manipulated and discrete frequency signals. Means are proposed for solving the problem of noise immunity of communication systems with NLS. The noise immunity of the reception of discrete and continuous messages is evaluated, and joint employment of NLS and correcting codes is considered. Much attention is given to methods for abatement of power noise in communication systems with NLS. The reviewer considers the book to be a substantial contribution to the literature concerned with communication systems which have NLS. Unquestionably it will prove to be useful for specialists in the communication field, as well as students and post-graduate students of radio engineering institutes of higher education.

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USE OF DEGENERATE SEQUENTIAL ANALYSIS IN CONNECTION WITH DIGITAL TREATMENT OF COMPOSITE SIGNALS

Moscow ELEKTROSVYAZ in Russian No 4, Apr 86 (manuscript received 2 Oct 84) pp 56-58

[Article by V.V. Shirokov and B.V. Fedotov]

[Abstract] An algorithm with respect to reception of composite signals is developed which combines the optimality of sequential analysis with simple technical realization of a receiver on a digital base. Figures 2; references 6: 5 Russian, 1 Western (in Russian translation).

6415/9716

CSO: 1860/262

NEW SYSTEM FOR BILLING HOTEL GUESTS

Moscow VESTNIK SVYAZI in Russian No 4, Apr 86 pp 19-21

[Article by V.V. Serdechnyy, chief, Automatic Control System Department, Sochi Municipal Production and Technical Administration for Communications]

[Abstract] Since the introduction of the new system of billing hotel guests for long-distance telephone calls in 1984, automatic long-distance dialing is possible in Sochi's 14 hotels with a total capacity of 4000 numbers. This required automation of the billing process by means of available computer technology by the Automatic Control System and the Long-Distance Telephone Exchange department of the Sochi Municipal Production and Technical Administration for Communications. The hardware for this billing system consists of a standard Elektronika-60 microcomputer with peripheral equipment which includes an FS-1501 photoelectric readout device and a Konsul-260 typewriter, non-standard mounting plates which match this microcomputer with AMTS-3 long-distance telephone keypunch controls and with selected telegraph channels, a T-63 KRTA monitor page-printing telegraph set, T-63 RTA page-printing telegraph sets installed in individual hotels, Ural and TVU-12 multiplexers for data transmission over the telegraph channels, and a YeS-1022 computer with standard peripheral equipment. The software consists of programs for the two computers, with a directory which lists telephone numbers and room numbers as well as hotel identifying code numbers. The programs for the Elektronika-60 are written in ASSEMBLER language with approximately 3800 operators in the input text and stored on magnetic tape. The programs for the YeS-1022 are written in GR/1 language and stored on 2.2 disks, more than 40 subroutines included to facilitate daily and monthly billing as well as statistical summarizing and decoding of reports. Figures 2.

2415/9716

CSO: 1860/206

DATA TRANSMISSION OVER OPTICAL CABLES

Moscow VESTNIK SVYAZI in Russian No 4, Apr 86 pp 25-27

[Article by G.I. Grodnev, candidate of technical sciences, and Ye.A. Malkov, engineer]

[Abstract] An analogy between operation of glass-fiber optical cables and operation of copper-conductor electrical cables is drawn on the basis of that between conduction current in a metal and displacement current in a dielectric. A fundamental difference is that, while electric currents require two conductors including one as return path, an optical cable constitutes a waveguide. Pulse code modulation is the established method of signal transmission over fiber-optic cables, such a cable being installed usually between a solid-state laser or a light-emitting diode for conversion of electric into optical signals at the sender end and a photodiode for conversion of optical into electric signals at the receiver end. Fiber-optic cables produced and installed in the USSR can be classified into single-mode trunkline cables, graded-index zonal cables, and graded-index local cables. Their three areas of application are data transmission (requiring high interference immunity, small size and weight, low cost, small attenuation, high channel capacity), automatic control and computers (requiring high interference immunity, small size and weight, and low cost), and mobile communication (requiring reliable safety features in addition to high interference immunity and small size and weight). It is with regard to these performance and design criteria that fiber optics outdo copper conductors, especially in the high-speed range from 34 Mbit/s up. Further improvements are feasible, much research being done in the USSR and abroad on fiber-optic communication lines with spectral multiplexing analogous to frequency multiplexing in radio communication lines. A passive optical device can serve as multiplexer-demultiplexer, a prism, a diffraction grating, or a light filter, depending on the wavelength at which the system operates. A major disadvantage of such a system versus a single-carrier fiber-optic communication system is that it requires an approximately 10% closer spacing of repeaters. Figures 9, tables 1.

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NEW METHOD OF ELECTROCHEMICAL PROTECTION

Moscow VESTNIK SVYAZI in Russian No 4, Apr 86 pp 27-29

[Article by M.A. Protasov, chief engineer, and O.V. Chamkina, senior engineer, Central Scientific Research Institute of Communications]

[Abstract] A comprehensive experimental study of underground long-distance communication cables was made, for the purpose of evaluating the effectiveness of magnesium rods as protectors against corrosion. For testing was selected a 2.3 km long segment buried in a soil with high electrical resistivity (81.8% SiO₂, 4.14% CaO, 3.78% MgO, 7.2% Fe₂O₃, 1.02% Al₂O₃, traces of SO₃). Water samples extracted from this soil were neutral (pH= 7) and contained,

average, 37.87% HCO_3^+ ions, 1.06% Fe ions, and 0.98% organic matter. The protector performance was determined electrically, on the basis of measurement of the potential differences from cable to ground and from protector to ground. The corrosion of sacrificial protectors was measured by weighing, after they had been cleaned of corrosion products in 10% CrO_3 anhydride and then dried. The average rate of dissolution was found to be 0.1364 g/(cm²·yr), which indicates a service life of 7 years allowing a total wear of 80%, with the cable current varying typically over the 140-680 mA range during that period. Extrapolation of the results indicates that, while magnesium rods provide adequate protection in soil with high electrical resistivity ($\rho > 100$ ohm·m), group protection is preferable in soils with low electrical resistivity ($\rho \leq 100$ ohm·m). A long magnesium rod will provide not only protection against corrosion but also shielding against electromagnetic interference from overhead electric transmission lines or electric railroads and some protection against lightning. Figures 2.

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SCHEME FOR REGISTERING SHORT FAILURES OF EQUIPMENT IN CENTRALIZED ELECTRICAL CONTROL SYSTEM

Moscow AVTOMATIKA, TELEMEXHANIKA, I SVYAZ in Russian No 2, Feb 86 pp 38-40

[Article by A.A. Konovalenko, senior engineer, Ruzhin track section, Far Eastern Railroad]

[Abstract] A scheme is proposed which will allow registering short failures of railroad automation equipment, specifically in the centralized electrical control system, and thus aid trouble shooting so as to enhance both safety and reliability of train movement. Particularly important is monitoring the preparedness of semaphores. The scheme is implemented by contactless modules with standard components mounted on two separate boards inside a relay box with a plug to a wall outlet in a SOU or SRKM bay. These modules come in three sizes: BFSH1 (10 KU101 thyristors, 10 D22 diodes, 10 MLT-0.5 2-30 kohm resistors) for registering faults in up to 10 devices, BFSH2 (5 KU101 thyristors, 5 D7 diodes, 5 MBM-160 0.1-0.25 uF capacitors, 10 MLT-0.5 2-30 kohm resistors) for registering faults in up to five rail circuits immediately behind a semaphore, BFSH3 (4 KU101 thyristors, 4 D7 diodes, 4 MBM-160 capacitors, 4 MLT-0.5 resistors) for registering faults in up to four devices in small stations with only two pairs of semaphores along major routes. All modules operate according to the same principle, the state of a thyristor being controlled by a positive pulse sent to the gate by the monitored device through its contact relay. Each thyristor is loaded by a lamp. The entire module is energized through a fuse, and the series resistor in the gate circuit is selected so that a thyristor will open only under a voltage of at least 22 V. This scheme should facilitate automation of trouble shooting. Figures 1.

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UNIFIED RAILROAD TRAFFIC CONTROL CENTER

Moscow AVTOMATIKA, TELEMekhENIKA, I SVYAZ in Russian No 2, Feb 86 pp 10-12

[Unsigned article]

[Abstract] Conversion to automatic passenger and freight traffic control on the Donets railroad line is to proceed in three stages and the line has been subdivided into three zones. The first zone includes the Zhdanov and Yasinovataya segments, through which the same trains pass. The second zone includes the Krasnolimansk and Yasinovataya segments, these segments tying in with the Moscow-Caucasus line and thus carrying the most heavy traffic. The third zone includes the Debaltsevo, Voroshilovgrad, and Popasnaya segments. This zoning will eliminate problems of intersegmental hookup, while centralization of all controls in one site will streamline the entire traffic control operation. An experimental automatic control center is already handling traffic on the Zhdanov segment since June 1985. It is essentially an information panel with visual display for monitoring the traffic situation in real time. The indication is schematic with use of red and green lines, dots, and arrows as well as numbers. The information display is provided by memory logic modules, each such module being an analog of six code servo-relays. A module contains a trigger which acts as register and storage, two output switches on the load side, indicator lights, and an additional switch for checking the state of the module in a comparator test circuit. Silicon transistors KT315G and KT608B are used for switches, the output switch being rated for a nominal d.c. current of 35 mA. Light-emitting diodes AL307B and AL307G are used for red lights and green lights respectively, IN-12B indicators being used for digital readout. Telephones and a switchboard are provided for interstation communication from the dispatcher's desk. Blueprints for this centralized automatic control panel were drawn under the guidance of senior engineers V.I. Kovalenko, V.P. Boytenko, V.I. Lola, M.K. Anikeyev, and senior electromechanic A.V. Zaretskiy. Figures 2.

2415/9716

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UDC 656.254.153.3:621.395.4

GENERAL PRINCIPLES OF ORGANIZING DIGITAL COMMUNICATION IN RAILROAD TRANSPORTATION SYSTEM

Moscow AVTOMATIKA, TELEMekhANIKA, I SVYAZ in Russian No 2, Feb 86 pp 16-18

[Article by V.L. Tyurin, doctor of technical sciences, professor, and V.V. Shmytinskiy, senior scientific associate, Leningrad Institute of Railroad Transportation Engineers]

[Abstract] The primary communication network in the railroad transportation system is based on analog data transmission. It consists of overhead lines

and various underground cables, a serious drawback further aggravated by fast aging and obsolescence of equipment. Replacement is therefore often necessary and new equipment is not always designed for a given mode of operation. One way to solve this problem and also increase the number of available channels for a growing demand is to modernize the existing communication network and introduce frequency division. Another way is to change over to digital data transmission. The advantages of digital data transmission are higher stability and reliability, better channel performance characteristics, simpler operating procedures, and lower cost. Problems in organizing a digital railroad communication network include adaptation of pulse-code-modulation equipment IKM-120 and IKM-480 to existing MKP and MKB railroad communication cables. This equipment, designed for a 600 km range, must be capable of covering a 2,500 km range with adequate interference immunity and this requires appropriate spacing of repeaters. Service communication and local traffic communication requires also special IKM-30 equipment with fewer channels at intermediate points. Still simpler equipment in small stations, along short spans, and along passing loops will require connection to K-24T telephone switching equipment and K-3 cables with frequency division. All these problems are being studied and solved at the Institute of Railroad Transportation Engineers, several variants of group channels with IKM equipment having already been designed. References: 5 Russian.

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POTENTIAL PRECISION OF CENTRALIZED ACTIVE SYNCHRONIZATION ALGORITHM

Moscow RADIOTEKHNIKA in Russian No 3, Mar 86 (manuscript received 4 Jun 85)
pp 25-27

[Article by Yu. A. Solovyev]

[Abstract] The creation of synchronous systems of radio communication and navigation assumes an active mutual synchronization of the time scale of the space-diversity subscribers. [Two of the three references concerned with the creation of such synchronous systems are taken from 1980 and 1982 editions of PLANS: Atlantic City, N.J.] It is accomplished by a measurement by each subscriber of the time intervals between moments of arrival of the radio signals of all the other subscribers and a priori by known moments of radiation of these radio signals. Use of an optimum centralized algorithm based on maximization of the a posteriori probability density assumes that all measurements are transmitted practically without a delay to a center where they are processed in order to obtain an estimate of the time scale divergency of the synchronized and reference subscribers. The statistical characteristics of the errors of the evaluations discussed are found and the indices of potential precision of central and active synchronization are introduced. Figures 2; references 6: 4 Russian, 2 Western.

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POTENTIAL RESOLUTION OF RADIO SYSTEM OF MOVING OBJECTS WITH A PRIORI UNCERTAINTY

Moscow RADIOTEKHNIKA in Russian No 3, Mar 86 (manuscript received 19 Sep 85) pp 27-30

[Article by A.N. Katulev and V.Z. Bogdanchuk]

[Abstract] The article introduces the concept and formulates a criterion for the quality of potential resolution. The properties of the resolution law are investigated. By potential resolution is understood a selection of the trajectories of each moving object with respect to a combined sample of measurements $X(t)$ accumulated at some interval of time where the maximum sensitivity and resolution of the radio system facilities are fully realized as determined by the matched filters of their receiving devices with both one and multilobe uncertainty functions. Figures 1; references: 4 Russian.

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EVALUATION OF TOTAL INDUSTRIAL RADIO INTERFERENCE WITH RANDOM QUANTITIES OF INDIVIDUAL COMPONENTS

Moscow RADIOTEKHNIKA in Russian No 3, Mar 86 (manuscript received 31 Oct 85) pp 91-93

[Article by A.P. Kalmakov]

[Abstract] In solving the problem of protecting radio reception from industrial radio interference (IRI) the necessity arises for regulation of the requirements on their level. In every case a receiver selected by chance from the system of radio communication under consideration operates in a complex electromagnetic arrangement where the interference is created by a complex of electrical equipment in which the number and type of the sources of interference are random. In a 1983 article by Kalmakov, approximate solutions were obtained for distribution of the probabilities for the effective efforts of the combined IRI procedures, when at the radio receiving device (RRD) interference effects are inserted into the electrical power supply network, or when a combined process is developed by interference emitted by the electric equipment. However, under real conditions, at the input of the RRD these combined interference processes act simultaneously. In the present article the distributions are considered of the probabilities of effective effort of the combined procedures of the IRI for these conditions and the possibility of evaluating the magnitude of interference at their base. The basic materials of this evaluation were reported at the 6th Symposium and Technical Exhibition of Electromagnetic Compatibility, Zurich, 1985 (in English). Four of the six references cited in the article are by Kalmakov. Figures 1; references 6: 5 Russian, 1 Western.

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UDC 621.373.826:621.3.049.77

LASER TECHNOLOGY FOR IMPROVING PRODUCTION OF PRINTED-CIRCUIT BOARDS: REVIEW

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 4, Apr 86 pp 35-39

[Article by D.Z. Kanevskiy, engineer]

[Abstract] The main trends in microelectronics are higher speeds of devices and higher degrees of circuit integration with better packaging. A key role in the manufacture is played by the printed-circuit board and in this area application of laser technology can bring about tremendous improvements. Photomasks can be produced and three types of plotters, all using a gas laser, have already been developed for this purpose: plane plotter, rotating drum, and stationary drum. The next step is to eliminate the photomask and plot directly, a plane laser plotter with pattern generator being available for this purpose. Subsequent operations of drilling holes, welding copper straps to connector pins, and soldering interconnections can also be performed by lasers. Equipment for drilling holes and immediately metallizing their surface by electric discharge has been recently developed in the USSR (I.V. Suminov, PRIBORY I SISTEMY UPRAVLENIYA No 9, 1985). For soldering has been developed and is now commercially produced the Kvant-50 facility with a YAG-laser, coordinate table, numeric program control, and television monitor. Other operations peripherally associated with production of printed-circuit boards and performable by lasers are cable stripping, cable welding to connectors, localized deposition of alloying metals, especially precious ones, marking boards and circuit components, and cutting precision glass masks as well as ceramic or plastic chip holders. Lasers are also used for contactless inspection and quality control, an automatic test stand with a high-speed scanning laser and a multiprocessor computer (Hughes Aircraft) or with a slow low-power continuous-wave YAG-laser and a control computer (Vanzetti Systems), and a laser-acoustic scanning microscope having been developed for this particular application. Figures 5; references 11: 2 Russian, 9 Western.

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COMPUTERS

UDC: 621.382

DETERMINING AND COMPARING COMPUTATIONAL PRODUCTIVITY OF SEMICONDUCTOR AND OPTOELECTRONIC INTEGRATED CIRCUITS

Moscow MIKROELEKTRONIKA in Russian Vol 15, No 2, Mar-Apr 86 (manuscript received 21 Feb 85) pp 99-108

[Article by K.K. Svedzinskiy]

[Abstract] Equations are presented for determining the computational productivity of integrated circuits in an attempt to develop a method of fair comparison of different sorts of circuits to determine the desirability of using various types of circuits in computers. The estimates of computational productivity generated differ significantly from those yielded by simplified Mf (megaflop) criterion, since in high speed logic circuits the productivity is practically independent of the number of logic elements. For optoelectronic circuits the calculated computational productivity is four orders of magnitude lower than the N^2 s criterion. The maximum productivities of semiconductor large scale integrated circuits and optoelectronic circuits are approximately the same, equivalent to the productivity of a computer of 100 megaflops. However, semiconductor devices actually achieve productivities an order of magnitude less, optoelectronic devices two orders of magnitude less, due to circuit capacity limitations. Figures 3, references 16: 12 Russian, 4 Western.

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PROBLEMS AND PREDICTION OF DEVELOPMENT OF VERY FAST VLSI COMPUTERS

Moscow MIKROELEKTRONIKA in Russian Vol 15, No 2, Mar-Apr 86 (manuscript received 19 Jun 85) pp 114-125

[Article by B.N. Faizulayev]

[Abstract] A study is made of the major problems related to the creation of very fast digital LSI and VLSI circuits at the current stage of development of microelectronic technology and of the hardware base for highly productive

computers. The central problem in the creation of highly productive computers is still one of increasing the speed of logic elements. There is a certain limit of logic element speed determined by permissible heat conditions and interconnection techniques even for circuits with the maximum degree of integration. The path to future increases in speeds lies through increasing the specific power of logic elements, decreasing the amplitudes of the signals they carry and improvement in interconnecting circuit designs. Another major problem is that of input-output contacts for matrix LSI and VLSI IC's. The creation of multiple-connector bodies for very fast VLSI circuits requires the solution of a number of interconnected electronic design, reliability, noise tolerance and manufacturing problems. Equally vexing is the problem of providing connections among logic elements on the chip, the area of connections now greatly exceeding the area of logic elements themselves. As chip real estate occupied by connecting lines increases, switching speeds decrease. Figures 7, references 13: 10 Russian, 3 Western.

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MULTIPLICATION DEVICES BASED ON STANDARD LARGE-SCALE-INTEGRATION MULTIPLIERS

Kiev ELEKTRONNOYE MODELIROVANIYE in Russian Vol 8, No 2, Feb 86 (manuscript received after revision 10 Sep 84) pp 39-43

[Article by Aleksandr Filippovich Kurgayev, candidate of technical sciences, senior scientific associate, and Vladimir Nikolayevich Opanasenko, graduate student, Institute of Cybernetics imeni V.M. Glushkov, UkSSR Academy of Sciences, Kiev]

[Abstract] Design of multiplication devices with LSI multipliers is considered, such a device being generally required to form, add, and shift partial products so that its speed will depend on the complexity of its structure. For design analysis and optimization, first is determined the number of partial products which will yield the end product with a given precision depending on the word length of the multiplicands. Power demand is usually the most critical design parameter along with speed, more so than the number of LSI frames and the cost, so that its dependence on the speed and on the word length is established next. This is done for a single-precision end product as well as for a double-precision end product. The analytical-numerical expressions for the power demand as a function of both speed and word length, the latter argument being a discrete quantity, are obtained by approximation with smooth functions according to the method of least squares. These expressions can be used for optimum design, typically with series KR1802 chips, under one constraint of speed not lower than a stipulated minimum or power demand not higher than a stipulated maximum, or under both constraints. Figures 2; tables 4; references 6: 5 Russian, 1 Western.

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EIGHT-CHANNEL INTERFACE DEVICE

Leningrad IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: PRIBOROSTROYENIYE in Russian Vol 28, No 12, Dec 85 (manuscript received 15 May 84) pp 43-46

[Article by A.V. Alekseyev, S.A. Butylev, S.M. Tronin, and M.S. Fedorov, Leningrad Electrotechnical Institute imeni V.I. Ulyanov (Lenin)]

[Abstract] An eight-channel interface for use with the SM-3 and SM-4 process control computer complexes is described that can be used to build single-machine and multiple-machine shared-resource computer systems with various configurations for difference applications. The interface is a universal remote communications adaptor that differs from existing devices in the number of channels, as well as the use of microprocessing technology, which makes it possible to reduce the amount of hardware required. The interface consists functionally of an address, control, and interrupt selector, a programmable serial adaptor unit, and a programming unit. The programmer sees the device as eight independent data channels employing DL-11W format, each with four software-accessible registers: An input status register, a data input register, an output status register, and a data output register. The device is fully supported by standard software, such as the RSX11M multiuser operating system, which makes it possible to use the device to set up minicomputer networks in an RSX11-DECNET environment. Figures 1, tables 1, references 2: 1 Russian, 1 Western.

6900/9716

CSO: 1860/165

DEVICE FOR INPUT OF GEOPHYSICAL DATA TO ELEKTRONIKA-60 MICROCOMPUTER

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 4, Apr 86 pp 33-34

[Article by S.S. Aleksandrov, candidate of technical sciences, A.V. Lukyanov, engineer, and A.V. Vafina, engineer]

[Abstract] Because the Elektronika-60 microcomputer is convenient to handle and its software is compatible with that of SM-3/4 computers, it is used for processing geophysical data. The data input to this microcomputer is effected by a multichannel pulse-parameter telemetering system. The data are quantized after having been registered, then enter the microcomputer in the interrupt mode through two standard parallel data transfer devices in accordance with the appropriate driver program. Preparation of data files for subsequent logging in the peripheral memory and display depends largely on microcomputer speed and loading. One possible way of loading is with direct access to the memory. A device facilitating this was developed for operation with a pulse-time telemetering system. It includes an address decoder, a register, an array of switches which output pulse-time data, synchronizing pulses, and frame, a channel number counter which receives the

frame and synchronizing pulses, a time-to-code converter, a logic trigger, a direct-access logic, a reference-frequency oscillator, and another array of switches between multiplexer, register, and microcomputer bus. The register can be modified so as to allow storage of data with shifts during pauses between quantization pulses, for averaging the results of geophysical measurements or for rejecting false readings in accordance with the upper bound principle. Figures 1.

2415/9716

CSO: 1860/268

UDC 681.518.42

SYNTHESIS OF ALGORITHMIC INVARIANT STRUCTURES OF TWO-CHANNEL ITERATIONAL SYSTEMS OF CONTROL WITH A DYNAMIC OBJECT

Novocherkassk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ELEKTROMEKHANIKA in Russian No 4, Apr 86 (manuscript received 11 June 85) pp 61-64

[Article by Boris Ivanovich Kuznetsov, candidate of technical sciences, senior scientific-research worker, Ukrainian Correspondence Polytechnical Institute]

[Abstract] Multichannel systems, including iterational systems, are an effective means for increasing the precision of automatic control. Questions are considered in the article with respect to synthesis of the structure of two-channel iterational systems of dynamic object control, in which a desirable iterational functioning algorithm is fulfilled invariantly with regard to the parameters and structure of the channel regulators. Figures 3; references: 3 Russian (The article is largely based on 1986 and 1984 items of which Kuznetsov is, respectively coauthor and author).

6415/9716
CSO: 1860/260

UDC 681.511.42.013

METHOD FOR CONTROLLING OBJECTS WITH INDETERMINATE CHARACTERISTICS

Leningrad IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: PRIBOROSTROYENIYE in Russian Vol 28, No 12, Dec 85 (manuscript received 17 Feb 85) pp 18-23

[Article by L.A. Mayboroda]

[Abstract] This study describes an approach to control synthesis that makes it possible to define the controls required without a priori knowledge of the characteristics of the controlled object, or the perturbations to which it is subject. The method is based on mapping the phase space of the movement of the controlled object onto the real axis, and studying the mapped movement during intervals that are selected in a specified way. The controls constructed on the basis of the proposed principle require minimum pre-adjustment,

and provide a wider range of application than existing systems. The approach can be used to describe every adjustable variable of the process, which makes it more difficult to synthesize the control for a multidimensional system, but results in superior control process characteristics. Figures 1, references: 9 Russian.

6900/9716

CSO: 1860/165

UDC: 621.315.592

ENERGY DIAGRAM OF METAL-OXIDE-GALLIUM ARSENIDE STRUCTURES

Moscow MIKROELEKTRONIKA in Russian Vol 15, No 2, Mar-Apr 86 (manuscript received 27 Mar 85) pp 129-134

[Article by P.K. Kashkarov, A.N. Obraztsov, I.N. Sorokin and Yu. N. Sosnovskikh, Moscow State University imeni M.V. Lomonosov]

[Abstract] A joint analysis of the results of measurement of the contact potential difference and current flowing through a dielectric is used to study the processes of charge accumulation in the anodic oxide on the surface of GaAs when struck by light in order to construct a zonal diagram of an Al-Anode oxide (Ao)-GaAs structure. Dielectric layers were created by anodic oxidation of n-GaAs single crystals in an electrolyte based on organic solvents. Specimens with oxide thickness 100 nm and 200 nm were used in the studies. MOS structures were created by vacuum atomization of semitransparent aluminum electrodes onto the 100 nm oxide in order to observe the penetrating currents. Contact potential differences were measured by the dynamic condenser method at 65 hertz. Reliable data were obtained on the energy structure of the GaAs-Ao heterojunction and the barrier for electrons at the Ao-Al boundary was determined. Processes of charge accumulation at the Ao trap upon illumination were studied, the sign of the charge carrier responsible for the dark current leak in the MOS structure was determined. Figures 5, references 12: 7 Russian, 5 Western.

6508/9716

CSO: 1860/244

UDC: 621.382

CURRENTS IN DIELECTRICS WITH TRAPS IN STRONG ELECTRIC FIELDS

Moscow MIKROELEKTRONIKA in Russian Vol 15, No 2, Mar-Apr 86 (manuscript received 12 Mar 85) pp 135-141

[Article by Ye.V. Grekov and O.G. Sukhorukov]

[Abstract] A study is made of the process of current flow in a dielectric with deep traps in the case of monopolar injection of charge carriers

(electrons). It was assumed that the traps capturing the electrons carry a negative charge, while traps without electrons are neutral. A system of equations was derived describing the process of transmission of the current. The equations allow estimation of the parameters of the traps and injecting contact based on the measured values of Q, x, I in the transient and steady processes. Figures 2, references 8: 4 Russian, 4 Western.

6508/9716

CSO: 1860/244

UDC: 538.775

SPACE CHARGE IN MOS STRUCTURES BASED ON INDIUM ARSENIDE

Moscow MIKROELEKTRONIKA in Russian Vol 15, No 2, Mar-Apr 86 (manuscript received 12 Mar 85) pp 142-145

[Article by V.A. Gurtov, M.V. Zolotov, A.P. Kovchavtsev and G.L. Kuryshev, Petrozavodsk State University]

[Abstract] A study was made of the influence of the effect of field processing and x radiation on InAs-based MOS structures made from epitaxial single crystal n-InAs specimens with an electron concentration of $2 \cdot 10^{16} \text{ cm}^{-3}$. The MOS structures were irradiated on an x-ray machine with a chromium anode at 300 K. Electrophysical properties were determined using the high frequency volt-farad characteristics method. Measurements were primarily performed at liquid nitrogen temperatures. It was found that field effects cause injection accumulation of a space charge in the InAs anode oxide, resulting from captured nonequilibrium electrons and holes on the trap in the dielectric. The kinetics of charge accumulation are logarithmic as a function of time. MOS structures with silicon dioxide do not show injection instability. MOS structures based on InAs with anodic oxide do not change their charge state upon exposure to x-rays. When silicon dioxide is used as the dielectric beneath the trap, x-ray bombardment causes the accumulation of a positive space charge alone, which is effectively annealed at 100-200°C. Figures 3, references 5: 4 Russian, 1 Western.

6508/9716

CSO: 1860/244

UDC 621.791.03

ELA-50/5M ELECTRON-BEAM UNIT

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST in Russian No 12, Dec 85 (manuscript received 13 May 85) pp 18-20

[Article by A.P. Bdulenko, I.M. Zilbershteyn, N.I. Panteleyev, I.A. Kutsayev, D.D. Tikhonov, and V.L. Fedorov]

[Abstract] In recent years key sections of the national economy have found more and more use for beam methods of processing materials, among them

electron-beam welding, which requires the creation and output of electron-beam welding equipment. This paper presents the technical characteristics, circuits, and construction of the ELA-50/5M electron-beam unit intended for welding of metals and alloys with a thickness up to 15 mm. A block diagram of the feeding device of the ELA-50/5M and an exterior photograph of the ELA-50/5M are presented. Figures 2; references: 4 Russian.

6415/9716

CSO: 1860/166

UDC 620.191:548.3:669.286

ELECTRON MICROSCOPE INVESTIGATION OF DISTURBED SURFACE LAYER OF MECHANICALLY POLISHED COPPER SPECIMENS

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST in Russian No 12, Dec 85 (manuscript received 11 May 85) pp 39-40

[Article by A.A. Tishchenko, N.V. Zagoruyko, and N.N. Bekkauer]

[Abstract] An investigation conducted with the aid of an ISI-60A (latin letters) scanning microscope describes the nature of the distribution of abrasive particles in broken near-surface layers of polished polycrystalline copper specimens. A qualitative study of the photomicrography shows that the density of the particles decreases with the depth of the etching, and charging of the particles in depth occurs according to the grain boundaries. The phenomenon of the localization of the abrasive particles at the grain boundaries can be used for study of the stressed and nonstressed boundaries as an indicator method. Figures 2; references 5: 3 Russian, 2 Western.

6415/9716

CSO: 1860/166

UDC 621.314.2

SYSTEM OF PULSE SECONDARY POWER SOURCES

Riga IZVESTIYA AKADEMII NAUK LATVIYSKOY SSR in Russian No 3, Mar 86 (manuscript received 19 Oct 84) pp 121-127

[Article by E.Ya. Kazaks and P.L. Korolkov, Institute of Electronic and Computing Technology, Academy of Sciences Latvian SSR]

[Abstract] The present wide introduction of electronics and computer technology requires the production of a large number of the most diversified electronic devices which have requirements concerned with the development of secondary power sources (SPS). Basic block diagrams of the construction of pulse SPS are presented and their advantages and deficiencies as compared with ordinary SPS circuits that use a power transformer are considered. A brief description and the basic parameters of a system of pulse SPS which has a power from 5 to 100 W are given. For several years the SPS system described has been used in a number of items for computing and

measuring-information technics developed at the Institute of Electronics and Computing Technology of the Academy of Sciences Latvian SSR. Its use confirmed the reliability and stability of pulse SPS, an advantage as compared with sources containing analog stabilizers, and consequently the advisability of their application. Figures 4; references: 7 Russian.

6415/9716
CSO: 1860/251

UDC: 621.385.6

ELECTRON-WAVE MECHANISM OF CONVERSION OF DIFFRACTED ELECTROMAGNETIC FIELD
TO RADIATION

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian
Vol 28, No 3, Mar 86 (manuscript received after revision 22 Jul 85) pp 58-64

[Article by A.I. Tsvik]

[Abstract] The first theoretical and experimental analysis is presented of processes of excitation of diffraction radiation considering electron-wave phenomena arising upon interaction of a stream of electrons with an electromagnetic field diffracted on a periodic structure. The results of the theoretical analysis are confirmed by experimental studies. The studies establish an electron-wave mechanism of excitation of diffraction radiation: a bulk wave striking a grid causes electron waves to be produced within the electron flux. These waves propagate along the beam at various phase velocities, exciting diffraction radiation under certain conditions at various angles to the surface of the periodic structure. A change in the conditions of synchronism of the electrons with the field of surface diffraction harmonics influences the angle and intensity of the diffraction radiation. Figures 2, references 6: Russian.

6508/9716
CSO: 1860/232

UDC 65.015.13

METHOD OF CHOOSING OPTIMUM EMERGENCY SETTING

Leningrad IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: PRIBOROSTROYENIYE in
Russian Vol 29, No 4, Apr 86 pp 92-95

[Article by I.O. Kozin and N.L. Sainikov, Obninsk Branch of Moscow Engineering
Physics Institute]

[Abstract] A method is presented which makes it possible to select an optimum emergency setting for technological processes on the basis of economic criteria and which can be helpful for the solution of analogous problems in nuclear energy, chemical production, and other sectors of the national economy. An example is given. The authors thank Ye.I. Ostrovsk for valuable advice with regard to the contents of the work. The article is recommended by the Department of Automated Control Systems. Figures 1; references 5:
4 Russian, 1 Western.

6415/9716
CSO: 1860/263

UDC 621.3.036.683

METHOD OF ANALYZING SIGNALS OF ELECTROMAGNETIC TRANSDUCER WITH A CYLINDRICAL CONDUCTING DEVICE

Leningrad IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: PRIBOROSTROYENIYE in
Russian Vol 29, No 4, Apr 86 (manuscript received 6 June 85) pp 64-67

[Article by A.A. Avramenko, B.M. Gorkunov, V.P. Sebko, and V.I. Tyupa,
Kharkov Polytechnical Institute imeni V.I. Lenin]

[Abstract] A simple method is proposed for determining the amplitude and phase of the normalized magnetic flux of an electromagnetic transducer with a homogeneous variable transverse magnetic field by means of a sounding cylindrical conducting device. It is assumed that the material of the device is characterized by constant values of the relative magnetic permeability, the electrical conductance and the field excitation while the device must be of sufficient length. A table presents the results of measured and calculated parameters of normalized electromotive forces for various specimens

allowing determination of magnetic fluxes. The article is recommended by the Department of Information-Measurement Technology. Figures 2; references: 5 Russian.

6415/9716
CSO: 1860/263

UDC 681.2

OPTIMAL DESIGN OF MEASUREMENT CHANNELS

Leningrad IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: PRIBOROSTROYENIYE in Russian Vol 28, No 12, Dec 85 (manuscript received 26 Nov 84) pp 6-11

[Article by V. K. Khromov, Moscow Engineering-Physical Institute]

[Abstract] This article describes a method for optimal design of measurement channels in measurement and control systems that does not require major resources, and can be implemented by a hand calculator in most cases. A measurement channel consisting of several devices connected in series is examined. The variables are either the components of the error, or the parameters that govern those components. A measurement channel consisting of a sensor and an analog-digital converter is analyzed as an example. The approach makes channel design significantly less expensive, and can be used with approximate initial data on the cost of the component devices. Figures 3, references 5: 4 Russian, 1 Western.

6900/9716
CSO: 1860/165

UDC [621.6:621.311].001.4

ENERGY CONSERVING AUTOMATION OF LARGE-SCALE ELECTROTHERMAL INSTALLATIONS

Moscow ELEKTROTEKHNIKA in Russian No 3, Mar 86 (manuscript received 27 May 85) pp 10-13

[Article by V.A. Kallistratov, V.N. Kovalev, candidates of technical sciences, and V.P. Davydov, engineer, All-Union Scientific-Research Institute of Electrothermal Equipment]

[Abstract] The energy conserving properties are shown of systems for automatic control of electrothermal processes in arc steel-smelting (450-600 kilowatt-hour/T) and ore smelting (3500-12,000 kilowatt-hour/T) electric furnaces. A block diagram is shown of a two-level system for automatic control of the DSP-100 I6 furnace with an UVK-2 (Control Computer Complex-2) and an ARDMT-2 type thyristor regulator. At the end of 1984 the first one of this system entered into operation at the Orsko-Khalilovsk Metallurgical Combine. A test of the operation of the control system showed its efficiency. Experimental investigations of the first microprocessor system of automatic control with the use of an UVK-2 of the RP3-63 ore smelting electric furnace

were successfully conducted at the Nikopolskiy Ferroalloy Plant. This plant uses a system for control of two furnaces with a SM-2 minicomputer at the second level. Figures 1; references: 5 Russian.

6415/9716

CSO: 1860/239

UDC 621.365.5.001.5

LOW-TEMPERATURE INDUCTION HEATING UNITS FOR VARIOUS TECHNOLOGICAL PROCESSES

Moscow ELEKTROTEKHNIKA in Russian No 3, Mar 86 (manuscript received 27 May 85) pp 16-19

[Article by V.Ye. Zhukovskiy, engineer, and A.B. Kuvaldin, candidate of technical sciences]

[Abstract] The theory and practice are studied of the units for induction heating of ferromagnetic steel (IHFS) employed in many areas of the national economy such as machine building and metallurgy, the chemical industry, and in construction and installation. Specific developments are considered such as those of the All-Union Scientific-Research Institute of Industrial Technology of Precast Reinforced Concrete Structural Parts and Products (VNIIZhelezobeton) and the All-Union Scientific-Research Institute of Electrothermal Equipment (VNIIEETO). A study of the technical-economical characteristics of the IHFS demonstrated that for many technological processes low-temperature induction heating is the most energy conserving. Figures 2.

6415/9716

CSO: 1860/239

UDC [621.365:621.78].004.18

REDUCTION BY THE USE OF ELECTRIC HEATING OF ENERGY EXPENDITURES FOR THERMAL WORK HARDENING

Moscow ELEKTROTEKHNIKA in Russian No 3, Mar 86 pp 8-10

[Article by A.P. Altgauzen and V.A. Berzin, candidates of technical sciences, All-Union Scientific-Research Institute of Electrothermal Equipment]

[Abstract] The reduction by the use of electric heating of the energy expenditures which occur during thermal work hardening of metallurgical articles was investigated. Electrical heating is shown to give rise to a substantial economy of primary energy resources, and of reserves for reduction of the energy expenditures by operating electrothermic equipment used for heat treatment. In order to maximize the energy conserving effect of electric heating measure, goal-oriented planning within a complex program is necessary. Items to be included in such a program are listed. Figures 1.

6415/9716

CSO: 1860/239

CONTROL ALGORITHMS FOR MULTISTRUCTURAL ELECTROMECHANICAL SYSTEMS

Novocherkassk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ELEKTROMEKHANIKA
in Russian No 3, Mar 86 (manuscript received 27 Sep 85) pp 51-58

[Article by Ilya Vasilyevich Miroshnik, candidate of technical sciences,
senior scientific research worker, Leningrad Institute of Precision
Mechanics and Optics]

[Abstract] The problem of controlling electromechanical systems, with significant departures from a limited point of movement, is frequently complicated by the nonlinear properties of an object, limitations on the controlling effect and variable states. In the majority of non-trivial cases, known methods of optimum control do not make it possible to find the closed control algorithms necessary for construction of regulations. Nonlimited systems are considered in the article, an optimum functioning quality of which is assured during movement in portions of the varieties of phase space. Algorithms of switching of structure and local regulators, algorithms of control of motion on a hypersurface, and control of a nonlinear electric drive are obtained. Figures 4; references: 11 Russian.

6415/9716
CSO: 1860/250

UDC 531.781.2.084.2:621.382

INTEGRATED-CIRCUIT SEMICONDUCTOR-TYPE SENSORS FOR STRAIN-GAGE TRANSDUCERS OF MECHANICAL QUANTITIES

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 4, Apr 86 pp 20-22

[Article by V.M. Stuchebnikov, candidate of physico-mathematical sciences]

[Abstract] Integrated-circuit semiconductor-type sensors for strain-gage transducers of mechanical quantities, while meeting the demand for miniaturization and producibility on a large scale at a low cost, do not quite satisfy all performance requirements which, in addition to high sensitivity and reliability, include also high accuracy and high stability over a sufficiently wide operating temperature range. The temperature range is determined not only by the material of these devices but also on the fabrication technology, particularly on the method of mounting and encasing. Silicon single crystals are now and will be in the foreseeable future the prevalent material for these devices, its temperature range being theoretically from near absolute zero to 600°C. The actual temperature range of sensors is, however, limited to -40°C at the lower end by weakness of the mounting and to +120°C at the upper end by breakdown of the p-n junction. The upper limit has been raised to +270°C by a special technology involving use of a dielectric insulation, but very tentatively. This deficiency is compounded by the low radiation resistance of silicon devices produced by diffusion or

implantation technology, also by their instability as main source of error. Improving the accuracy of these devices dealing with the problem of non-linearity. Methods developed and tried so far are optimization of physical-technological characteristics (doping level, dopant distribution), optimization of design-technological characteristics (shape, size, location, mounting configuration) and circuit methods (insertion of passive elements into strain measuring circuit or of compensating elements into converter circuit with active element). The latest breakthrough are integrated-circuit chips with heteroepitaxial silicon-on-sapphire structure without p-n junction. Strain-gage transducers with such sensors are still only produced in the form of flat membranes and complete replacement of conventional integrated-circuit silicon sensors is not yet feasible. The latter still offer the advantages of easy fabrication, especially precision grinding and anisotropic etching, as well as a much lower cost. They are still preferred for consumer goods such as automobiles and appliances, not subject to stringent requirements. Devices with silicon-on-sapphire structures will, however, invade the industrial general-purpose and special-purpose market especially in the field of microprocessors and automation, when technologies of their precision grinding and stable rigid mounting on ceramic to withstand temperatures up to 900°C have been developed with a partial compensation of the high cost of silicon-on-sapphire. Figures 5; references 23: 12 Russian, 9 Western.

2415/9716
CSO: 1860/268

UDC 681.327

ORGANIZATION OF DATA EXCHANGE BETWEEN ELEKTRONIKA DZ-28 MICROCOMPUTERS

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 4, Apr 86 p 33

[Article by M.L. Shishakov, engineer]

[Abstract] The number of Elektronika DZ-28 microcomputers manufactured and used in the USSR is steadily increasing, mainly for control and automation, all versions of this model being compatible with a broad range of peripheral equipment. The latter includes built-in storage cassettes, monitors of photoelectric readout devices, punches, Consul 260.1 or Robotron-1156 printers, also displays and flexible magnetic storage disks. The speed of data exchange is very slow, however, only 150 byte/s from punch to microcomputer and only 1500 byte/s from microcomputer to photoelectric readout device. A device for organizing data exchange between two Elektronika DZ-28 microcomputers at a speed up to 35 kbyte/s is now proposed, essentially an interface containing an address decoder and two registers generating interrupts in their respective microcomputer and resettable by the latter. This interface is built with 15 integrated-microcircuit chips: 3 of series K559, 11 of series K155, 1 of series K55. Figures 1; references 1: Russian.

2415/9716
CSO: 1860/268

INSTRUMENTATION & MEASUREMENTS

ELECTRONIC FLOW METER

Moscow RADIO in Russian No 1, Jan 86 pp 14-16

[Article by I. Semenov, I. Savalyev and V. Konoplev, Moscow]

[Abstract] A simple flow meter is described which can be used for a broad range of liquids, especially engine fuels but also non-aggressive opaque liquids. It consists of a transducer inserted into the main fuel line immediately before the carburetor and an electronic module. The transducer, inside a cylindrical housing, contains a rotating disk with three vanes 120° apart on a hub around the shaft and with 18 equidistant holes around a circle near the periphery. It also contains a light-emitting diode and a light-activated diode mounted on both sides of the disk so that, as the latter rotates, the luminous flux from the LED to the LAD is periodically passed through and chopped. The electronic circuitry into which both diodes are connected consists of a matching amplifier on two transistors with an integrating RC network in the input stage, a pulse-shaping logic with a multivibrator triggered by a negative pulse from a differentiating RC network and generating 8 ms pulses, and an inverter through which these pulses pass to a counter as well as to a microammeter. The count rate is 4000/h. The microammeter measures the flow velocity. The instrument has been designed for 10 l/h maximum flow velocity and a 0.1 l discreteness of measurement. The number of pulses per liter builds up with increasing flow rate, to $20,000 \pm 10\%$ depending on the transducer material and design, whereupon it remains constant at that level beyond 1.5-2 l/h. The transducer must, however be calibrated after assembly and anew for each different liquid. Figures 2.

2415/9716

CSO: 1860/205

FORMING OF NARROW PULSES WITH SMOOTHLY-CONTROLLED VARIABLES

Riga IZVESTIYA AKADEMII NAUK LATVIYSKOY SSR in Russian No 3, Mar 86
(manuscript received 8 Jun 84) pp 110-115

[Article by K.Ya. Kruminsh and R.Ya. Stasha, Institute of Electronics and Computing Technology, Academy of Sciences Latvian SSR]

[Abstract] Pulse generators which form pulses with a duration of the front and a decay in several hundreds of picoseconds are used for metrological tests of broad-band equipment. Ordinarily such generators form pulses with a constant amplitude and duration. However, in a number of tests it is necessary to have a signal with a smoothly-controlled amplitude and duration of the pulse. As a solution to this problem, in 1982 Kruminsh and Stasha proposed a new device for forming narrow pulses which contains a forming line with a sliding unit located in it that constitutes an electrically controlled resistance. The reaction of the line at a discontinuity of the line's feed current is used to form the pulse. For a discontinuity of the feed current, the effect is used of restoration of the back resistance of a diode with charge accumulation. The parameters of the output pulses (amplitude and width) are regulated by means of a change of the magnitude of the resistance and the position of the slide in the forming line. The emitter-collector junction of a high-frequency transistor is used as a controlled resistance. A theoretical analysis and the results of experimental investigations of the former are presented. Figures 5; references: 2 Russian.

6415/9716
CSO: 1860/251

UDC 621.317.3.001.2

UTILIZATION OF SIGNAL DELAY FOR CORRECTION OF THE TRANSIENT RESPONSE OF A STROBOSCOPIC CONVERTER

Riga IZVESTIYA AKADEMII NAUK LATVIYSKOY SSR in Russian No 3, Mar 86 (manuscript received 2 Jan 85) pp 116-120

[Article by K.Y. Kruminsh and R. Ya. Stasha, Institute of Electronics and Computing Technology, Academy of Sciences Latvian SSR]

[Abstract] The essence of the correction method described involves the intentional distortion of the input signal in such a manner that the distortion is counteracted by distortions inserted by the time lag of the stroboscopic converter. The intentional distortion is created by splitting the input signal with the aid of a T-joint at two identical signals and by the delay of one signal with respect to the other at some optimum time, and the admission of both signals at the input of a differential stroboscopic converter with various weight coefficients. In practice the converter with a root-mean-square deviation of the noise signal of 40 MV as a function of the

installed magnitude of delay had a rise time of the transient response in the limits of 70 to 119 picosecond. In a similar device without correction of the rise time, the transient response was equal to 150 picosecond. Thus the experimental investigations conducted show that using the principles of correction described, a twofold decrease of the rise time of the transient response occurs, which in its turn indicates a twofold enlargement of the band width of the converter. Figures 5; references: 10 Russian.

6415/9716

CSO: 1860/251

MAGNETICS

UDC [621.791.754.621.86.062].002.2

UNIT FOR BONDING WELDING OF POLE PIECES OF LOAD-CARRYING ELECTROMAGNETS

Moscow ELEKTROTEKHNIKA in Russian No 3, Mar 86 p 59

[Article by D.A. Bessmertnyy and V.V. Krivospitskaya, Engineers, Krivbass Electrical Repair Production Association]

[Abstract] A unit developed at the Krivbass Electrical Repair Production Association makes it possible in a semiautomatic system to accomplish bonding of the pole pieces of load-carrying circular-form electromagnets of types M21, M22, M41, M42, M61, and M62 with all modifications. The semiautomatic Type PDG-508, equipped with a Type VDU-504 rectifier is used for direct-current welding in a carbon dioxide environment. A drawing of the unit and technical data are presented. The annual economic gain due to introduction of the unit amounts to approximately 8 thousand rubles. Figures 1.

6415/9716

CSO: 1860/239

UDC 621.316.925(088.8)

NOISE PROOF DEVICE FOR INDICATING THE APPEARANCE OF NORMAL PHASE IN SUPER-CONDUCTING MAGNETS

Novocherkassk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ELEKTROMEKHANIKA in Russian No 3, Mar 86 (manuscript received 12 June 84) pp 76-80

[Article by Sergey Vladimirovich Vasilyev, candidate of technical sciences, senior scientific-research worker, Leningrad Polytechnic Institute imeni M.I. Kalinin; Ivan Dmitriyevich Lupkin, candidate of technical sciences, senior scientific-research worker, All-Union Scientific-Research Institute of Electrical Machine Construction; Gennadiy Yevgenyevich Sereda, senior scientific-research worker, Leningrad Institute of Railroad Transportation Engineers; and Yuriy Vasilyevich Yudakov, candidate of physico-mathematical sciences, senior scientific-research worker, Leningrad Institute of Railroad Transportation Engineers im. Academician V.N. Obraztsov]

[Abstract] Transition of superconducting magnets (SCM) into a normal state and release of the energy within the SCM can give rise to considerable

overheating of the winding and even its destruction. Consequently, timely discovery of the appearance of normal phase and the output of energy from the SCM are obligatory conditions for accident-free operation. A device for indicating the appearance of normal phase (DIANP) is an integral part of the protection system for the SCM. A description is given of such a unit which makes it possible slowly to separate the varying normal phase signal in SCM on a background of noise, by the amplitude. The threshold of operation of the device is regulated within the limits of 0.01-1 V, and an operating delay within the limits 0.01-0.1 second. Block diagrams are presented of: 1) traditional usage DIANP; 2) Timing charts of DIANP operation; and 3) Noise proofing of DIANP.

6415/9/16

CSO: 1860/250

UDC 621.313:536.483:681.3.06

NUMERICAL CALCULATION OF PROCESS FOR ADJUSTING SUPERCONDUCTING MAGNETIC SYSTEM OF CYROGENIC ELECTRICAL APPARATUS

Novocherkassk IZVESTIYA VYSSHIKH UCH UCHEBNYKH ZAVEDENIY: ELEKTROMEKHANIKA in Russian No 3, Mar 86 (manuscript received 25 Apr 85) pp 72-75

[Article by Andrey Serafimovich Veselovskiy, engineer, scientific laboratory of All-Union Scientific-Research Institute of Electromechanics, Aleksandr Ivanovich Plis, candidate of physico-mathematical sciences, assistant professor Moscow Power Engineering Institute, and Stanislav Sergeyevich Skvortsov, candidate of physico-mathematical sciences, senior scientific-research worker, All-Union Scientific-Research Institute of Electromechanics]

[Abstract] The rate of adjustment of cryogenic electrical machines is dictated by the level of permissible mechanical deformations which occur because of the temperature gradient during cooling of the superconducting magnetic system (SMS). In order to determine the mechanical stresses in the SMS and the choice of structural decisions which makes it possible to reduce these stresses, it is necessary to determine the temperature fields of the SMS and the units of the cryostat. A method for solving the process of adjustment of the SMS is presented which makes it possible to attain these goals. The solution is considered of a nonstationary nonlinear problem of the conjugate heat exchange that takes place during the flow of the gaseous cryoagent in the slotted channel of the magnetic system of the SMS. Figures 1; references: 4 Russian.

6415/9/16

CSO: 1860/250

HIGH CAPACITY MAGNETIC MEMORY DEVICES BASED ON VERTICAL BLOCH LINES

Moscow MIKROELEKTRONIKA in Russian Vol 15, No 1, Jan 86 (manuscript received 6 May 85) pp 3-15

[Article by S. Ye. Yurchenko, Institute of Control Problems]

[Abstract] In 1983, the possibility was demonstrated of practically implementing the idea of using pairs of vertical Bloch lines located within the domain structure of a magnetic bubble or strip to record information in semiconductor memories. This means the possibility of a 1 cm^2 chip with an information capacity of 1.6 gigabits and an access time of 100 ms (10 ms at 10 gigabits). This article describes the properties of such potential vertical Bloch line memories and the principles of functioning of semiconductor memory devices based on them. The problems of controlling the formation of vertical Bloch lines, their movement, reading and annihilation have been basically solved. This means it is now possible to develop such memories capable of competing with all other types of storage devices, including disk drives with vertical information recording. Such memory devices are just now beginning to be produced. Many physical phenomena influencing the viability of the memory devices remain unknown, including the influence of film characteristics on stability and properties in external magnetic fields and at various temperatures, the stability of the vertical Bloch lines over time, and the question of detecting vertical Bloch lines at high densities. Figures 6, references 40: 9 Russian, 31 Western.

6508/9716

CSO: 1860/221

UDC 681.84.083.84

PRODUCTION AND PROPERTIES OF MEDIA FOR PERPENDICULAR MAGNETIC RECORDING

Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 3, Mar 86 pp 12-21

[Article by Yu.A. Vasilevskiy and L.I. Zelenina, State Scientific Research Institute for Chemical and Photographic Equipment Design]

[Abstract] The magnetization of the medium used in longitudinal magnetic recording runs predominantly lengthwise along the medium and the opposite poles are on the same side of the working layer. With perpendicular recording, the magnetization is oriented for the most part perpendicularly to the working layer surface and the opposite poles of the magnetized sections appear on the opposite sides of the medium. In the latter case, a closing or shunting layer is used between the magnetized layer and the substrate so as to increase the flux. Perpendicular recording offers an increase of 5 to 10 times over that attainable with conventional longitudinal recording techniques. This paper is a review of vertical recording media technology based on Japanese and U.S. literature. A discussion of the specific

characteristics of the media is followed by analyses of the various materials for the working layer and the technologies used for the fabrication of vertical recording media. Figures include schematic drawings of the magnetic media, different head configurations, schematics of the columnar magnetic texture of the working layer, the saturation magnetization, anisotropy and coercivity for both perpendicular and longitudinal magnetization as well as the perpendicular anisotropy constant and I_{002} diffraction pattern peak height as a function of the Cr content in an Co-Cr layer. Cathode sputtering of Co-Cr films is discussed in some detail. The maximum recording density attained thus far is 6,000 magnetic reversals per mm in a two-layer medium with a Co-Cr working layer (as opposed to the theoretical limit of 20,000 reversals per mm). This review paper provides no information on Soviet R & D efforts in this field. Figures 7; references 53; 2 Russian, 50 Western (1 in Russian translation).

8225/9716

CSO: 1860/234

DOC 671 115 :538.945 .017.001.24

CALCULATION OF POWER LOSSES IN TRANSPOSED SUPERCONDUCTOR CONDUITS

Moscow ELEKTROTEKHNIKA in Russian No 1, Jan 86 (manuscript received 25 Sep 85) pp 47-51

[Article by S.G. Akopov, candidate of physico-mathematical sciences, G.G. Svalov, doctor of technical sciences, and V.Ye. Sytnikov, candidate of technical sciences, All-Union Scientific Research Institute of the Cable Industry]

[Abstract] Superconductor conduits for a.c. magnet systems are usually transposed for better performance. The power losses produced by eddy currents leaking from one wire to another must be added to conventional hysteresis loss and loss produced by eddy currents flowing in each wire. This loss is calculated here on the basis of a three-dimensional model representing a multilayer conduit which consists of N wires rectangular in cross-section, in a single-twist configuration. Vertical resistances in this model represent lumped contact resistances between crossing wires of different layers and horizontal resistances in it represent distributed resistances between parallel wires within one layer. First is considered an alternating magnetic field which changes slowly so that all conduit segments remain in the superconducting state. Different expressions are obtained for the power loss in a normal magnetic field and in a transverse one respectively, the ratio of the power losses in the two cases depending on the number of wires and the wire diameter as well as on the magnetic field intensity. Next is considered an alternating magnetic field which changes sufficiently fast for a transition of conduit segments to the normal resistive state, in which case the eddy currents leaking between wires within one layer become negligible. In this case the current-voltage characteristic of the wires is assumed to be known and the main current through the winding is assumed to be zero. The calculations are in all cases based on the appropriate formulation of Ohm's law and on contact resistances which include solder impregnation of wire strands for necessary mechanical rigidity. The theoretical results agree closely with experimental data. Figures 4; references 4; 2 Russian, 2 Western.

2415/9716

CSO: 1860/212

UDC 537.876.45:621.372.8

CALCULATION OF REFLECTION FACTOR OF ELECTROMAGNETIC WAVE FROM WEDGE-SHAPED RADIOABSORBING STRUCTURE

Novocherkassk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ELEKTROMEKHANIKA In Russian No 4, Apr 86 (manuscript received 8 May 84) pp 9-15

[Article by Vladimir Ivanovich Ponomarenko, candidate of technical sciences, assistant professor, Simferopol State University]

[Abstract] The problem is solved of calculating the reflection factor of a wedge-shaped dielectric radioabsorbing structure, recurrent with respect to the X axis and uniform with respect to the Y axis, in the range of wave lengths comparable with the characteristic dimension, $\lambda \sim a$. The normal incidence (along the Z axis) of a plane electromagnetic wave polarized along the X axis or the Y axis is considered. A modification of the Bubnova-Galerkin method is presented for solution of excitation through an irregular resonator. Finding the amplitude of a scattered field and reflection from a wedge-shaped structure (calculation by projection method) are studied. A comparison of the results of numerical calculations with the projection and approximate quasi-statistical methods shows the possibility of using the latter for estimation calculations of the reflection factor from a wedge-shaped structure. Figures 5, references: 9 Russian (including 3 articles from Russian journal "Foreign Radio Electronics").

6415/9716
CSO: 1860/260

TRANSMISSION MATRIX OF A LENGTH OF MULTICONDUCTOR MICROSTRIP LINE

Novocherkassk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ELEKTROMEKHLANIKA in Russian No 4, Apr 86 (manuscript received 9 Jan 84) pp 15-18

[Article by Sergey Vasilyevich Mushenko, candidate of technical sciences, assistant professor, Taganrog Radiotechnical Institute, and Kachik Ovanesovich Kazandzhyan, engineer, Taganrog Radiotechnical Institute]

[Abstract] Magnitudes are listed by which the transmission matrix is determined of a length "L" for an arbitrary value of the frequency of the electromagnetic oscillations. It is assumed that only fundamental forward-travelling and reverse waves are propagated in the line. References: 3 Russian. (Two of the references are by Mushenko and Kazandzhyan; 1 is by Mushenko.)

6415/9716
CSO: 1860/260

UDC: 621.373.82

MATCHING IMPEDANCES IN PARATELLURITE ACOUSTICAL ELECTRONIC DEVICES

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 28, No 3, Mar 86 (manuscript received after revision 8 Apr 85) pp 94-96

[Article by A.A. Stashkevich]

[Abstract] A study is made of the possibility of excitation of a slow shear acoustical wave with [110] polarization from the (001) base in paratellurite with subsequent reflection in the [110] direction. Conditions are developed for equality of energy fluxes in the incident and reflected waves. Requirements are formulated for the thickness of the acoustical coupling, allowing significant expansion of the frequency characteristics of acoustico-electronic devices based on paratellurite without the use of additional matching devices. Figures 2, references: 5 Russian.

6508/9716
CSO: 1860/232

EXPERIMENTAL STUDY OF ELECTRIC FIELD DISTRIBUTION IN CYLINDRICAL AND IMAGE SLOT LINES

Gorkiy IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOFIZIKA in Russian
Vol 29, No 3, Mar 86 (manuscript received 28 Jan 85) pp 346-354

[Article by G.I. Komar and V.P. Shestopalov, Institute of Radiophysics and Electronics, UkSSR Academy of Sciences]

[Abstract] A 2-coordinate measuring line with 2-coordinate manipulator moving the probe was used for mapping the electric field in laboratory models of cylindrical slot lines (circular cylindrical dielectric rod wrapped with longitudinally slotted thin conducting shield) and image slot lines (rectangular dielectric bar on conducting base as part of shield, other part of shield wrapped around remaining three sides but shorter at one end so as to leave a gap instead of rejoining the base), with various millimetric-wave transitions (4 mm band, 8 mm band). All three field components E_ϕ, E_r, E_z were measured, the results yielding the electric field distributions in cylindrical slot lines with a slow surface wave or with a fast volume wave and revealing anomalies of the electric field distribution in image slot lines attributable to charge concentration at the shield edge. Figures 6; references: 14 Russian.

2415/9716

CSO: 1860/249

UDC 621.385

PECULIARITIES OF HIGHER MODES OF ELECTRON-WAVE INTERACTION IN OROTRON - DIFFRACTION RADIATION GENERATOR DEVICES

Gorkiy IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOFIZIKA in Russian
Vol 29, No 3, Mar 86 (manuscript received 18 Sep 84) pp 355-361

[Article by A.A. Shmatko, Kharkov State University]

[Abstract] Excitation of higher-order longitudinal modes in the open resonator of a diffraction radiation generator with subsequent interaction of the electron beam and the millimetric-wave resonator field are analyzed, taking into account the space charge produced by the electron beam. The analysis is based on the mathematical model of a self-consistent interaction process involving an electron beam which passes close to a periodic grating inside the resonator. This model, with usual approximations applicable to such devices, reduces to a system of nonlinear integro-differential equations for the generator output characteristics: electronic efficiency and electronic frequency shift as well as amplitude of the generated m -th mode. After the starting conditions have been established, in terms of Gauss-Hermite functions, a numerical solution reveals existence of large-amplitude generation bands with respect to the relative asynchronism or the accelerating voltage.

The number of these bands, which distinguish higher-mode interaction from fundamental-mode interaction, is determined by the order of the mode. The space charge influences the starting conditions in that an increase of the velocity of the space charge wave and correspondingly of the space charge parameter in terms of plasma frequency causes the minimum starting current to increase and to shift toward larger initial asynchronism between electrons and slowed m-th harmonic. Figures 3; references 11: 10 Russian, 1 Western.

2415/9716

CSO: 1860/249

UDC 621.373.39.029.64.072.9

FILTRATION CHARACTERISTICS OF SYNCHRONIZED SURFACE-ACOUSTIC-WAVE OSCILLATOR IN MICROWAVE FREQUENCY RANGE

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 31, No 1, Jan 86
(manuscript received 28 Jun 84) pp 169-172

[Article by A.M. Zaslavskiy, V.N. Posadskiy and E.A. Semenov]

[Abstract] The filtration characteristics of microwave SAW oscillators with respect to noise and deterministic discrete signal components were measured in an experiment with frequency-modulated signals passing through a synchronized 1.8 GHz SAW oscillator. This oscillator included a high-frequency amplifier with a narrow-band SAW delay line in the feedback loop and a pair of interdigital transducers consisting of 15 sections each. Groups of extra "idle" electrodes at ground potential were inserted in the gaps between transducer sections, for suppression of parasitic acoustic echo signals. In the first part of the experiment a reference signal from a G4-78 high-frequency oscillator was frequency-modulated by a low-frequency noise from a G2-37 generator (1 V rms, 6.5 bandwidth) and subsequently applied to the SAW oscillator input, whereupon the spectral density of noise power was measured at the SAW oscillator output. In the second part of the experiment a signal from the G4-78 oscillator was frequency-modulated by a signal from a low-frequency oscillator. The results indicate that a synchronized SAW oscillator is an effective filter and will generate high-purity signals for such devices as frequency synthesizers. The authors thank A.A. Muravyev, A.R. Zulkharayev, and I.A. Muravyeva for producing the interdigital transducer structure, S.I. Avdyukhov for designing the amplifier circuit, and L.I. Rabinovich for helpful discussions. Figures 3; references: 2 Russian.

2415/9716

CSO: 1860/210

ANALYSIS AND OPTIMIZATION OF MULTICHANNEL SYNPHASAL BINARY MICROWAVE POWER DEVICES

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 31, No 1, Jan 86 (manuscript received 8 Feb 83) pp 191-195

[Article by V.A. Sledkov and A.D. Chuprin]

[Abstract] An exact method of calculating the voltage standing-wave ratios and the decoupling impedances in 2^N -channel microwave power dividers with arbitrary numbers of stages in each channel is devised which involves superposition of 2^N elementary excitation modes at the divider outputs so that the performance analysis reduces to consideration of equivalent four-pole networks. It utilizes the symmetry of a binary structure, takes into account mirror reflections, and introduces fictitious electric or magnetic walls through each node determining any particular mode of operation: all magnetic walls in the case of synphasal operation. On the basis of such an analysis were constructed a design algorithm and an optimization program, specifically for synphasal power dividers and improvement of their frequency characteristics. They were used for synthesis of three 5-section 4-channel power dividers, one consisting of identical 2-section dividers connected through quarter-wavelength line segments, one representing an optimized version of the latter, and one with all five quarter-wavelength sections forming a single matching transformer. They have excellent frequency characteristics over an octave band. Similarly a 5-section 8-channel power divider and a 13-section 4-channel power divider were synthesized. Figures 3; tables 1; references 6: 5 Russian, 1 Western.

2415/9716

CSO: 1860/210

UDC 621.585.62.01

THEORY OF RESONANT AMPLIFIERS WITH LONG INTERACTION, PART 3

Gorkiy IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOFIZIKA in Russian Vol 29, No 2, Feb 86 (manuscript received 26 Nov 84) pp 210-218

[Article by D.M. Vavriv and O.A. Tretyakov, Kharkov State University]

[Abstract] A self-consistent theory of O-type amplifiers with distributed interaction is constructed on the basis of equations of excitation for the amplitude and the phase of microscopic electromagnetic oscillation in the output stage. These equations are solved simultaneously with the equation of motion for the electron beam, the initial conditions being velocity modulation and density modulation of the electron beam without an upper limit on the premodulation level. This system of equations can be solved analytically in the approximation of a linear phase deviation of electrons from the synchronous wave. As the magnitude of the beam current increases and approaches the magnitude of the starting current, however, this phase deviation ceases to be

almost linear and field saturation occurs. Amplifier gain and efficiency have been calculated numerically as functions of the modulation level and as functions of the ratio of signal power to beam power, for ratios 0.5, 0.8, 0.9 of beam current to starting current. Calculations were made for the two special cases of velocity modulation only with the klystron modulator at the entrance to the amplifier stage and density modulation only with the klystron modulator at a certain distance farther along the amplification stage as well as for the general case of both modulations. The results reveal that maximum efficiency is attainable with density modulation and with an open resonator in the output stage, this maximum attainable efficiency being determined by the beam accelerating voltage. Velocity modulation causes the optimum bunching to depend on the parameters of the output resonator. Figures 3; references: 8 Russian.

2415/9716

CSG: 1860/215

UML 35.844-4

IMPROVING SENSITIVITY OF BWA SCANNING MICROWAVE SPECTROMETER BY MEANS OF QUASI-OPTICAL RESONATOR

Gorkiy IZVESTIYA VESSHIKH RUSSEKH TSEKHENIY: 2415/9716 In Russian
Vol 29, No 2, Feb 56 (manuscript received 21 Apr 56) pp 240-242

[Article by V.P. Kazakov, V.V. Parshin, and V.M. Smirnov, Institute of Applied Physics, USSR Academy of Sciences]

[Abstract] Use of a quasi-optical resonator for improving the sensitivity of a BWA (backward-wave amplifier) scanning millimeter-wave spectrometer is evaluated on the basis of experimental data and theoretical considerations. Experiments were performed with a backward-wave tube oscillator as the radiation source, a bimetallic horn waveguide leading to the resonator cavity with an acoustic detector, and an optical stage for alignment of the resonator axis relative to the horn on the oscillator side as well as for adjustment of the standing-wave ratio in the waveguide. A setup with low-pass filters suppressed acoustic noise in the absorption cell. Tests were performed at weak lines of an H_2O molecule in vibrationally excited states 001, 100, 040, 030 and at the line of PH_3 impurity in CH_4 over the 200-300 GHz frequency range. In the scanning mode at resonance with the 031⁰ line ($J=14 \rightarrow 15$ transition) were also detected weak lines of vibrationally excited states 00⁰1 and 20⁰0, not previously detected by scanning the rotationally excited spectrum. Although the resonator method precludes detection of weak lines along the tails of intense transitions, detuning from one line will extend the high sensitivity over a wide range of the spectrum. A sensitivity of 10^{-11} cm⁻¹ within a time period of the order of 1 μ s should be attainable with a tunable rather than fixed quasi-optical resonator. A disadvantage of this method is the need to lock the resonator frequency to the oscillator frequency, which makes it difficult to find weak lines of not exactly known frequencies. The authors thank A.F. Krupnyy for formulating the problem and discussing the results. Figures 3; tables 1; references 1; 2 Russian.

2415/9716

CSG: 1860/215

CONSTRUCTION OF THE UNIFORM MICROWAVE STRUCTURES OF HIGH-SPEED COMPUTERS

Moscow RADIOTEKHNIKA in Russian No 3, Mar 86 (manuscript received 17 July 85)
pp 3-9

[Article by O.D. Barantseva]

[Abstract] A detailed description is given of the distinctive constructive features used in modeling circuits of the cells of a microwave uniform computational structure (UCS) with microwave devices having electric hysteresis, as well as elements and functional microwave units among the cells of a microwave UCS for a high-speed digital computer. It is concluded that the cells of a microwave computer structure utilizing microwave industrial devices with electric hysteresis (or negatrons) make it possible to accomplish modeling of various units of an electric digital computer with control of the video- or radio-frequency pulses and with a combination of their action. High-speed cells of a microwave UCS are reliable in operation even when exposed to large gradients of temperature and radiation. It is possible to fulfill them constructively in the form of an UCS and to arrange without crossings the interconnections in the two layers of the matrix (or with two sides of the UCS board). Figures 6; references 7: 6 Russian, 1 Western.

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CSO: 1860/243

UDC 621.317.335.3

EXPRESS METHOD OF MEASURING RELATIVE DIELECTRIC CONSTANT

Moscow RADIOTEKHNIKA in Russian No 3, Mar 86 (manuscript received 8 July 85)
p 94

[Article by V.I. Afromeyev and Yu.A. Pokrovskiy]

[Abstract] A method is proposed for measuring the relative dielectric constant (ϵ) based on a measurement of the critical length of a waveguide filled by the dielectric under investigation. An experimental check of the proposed method was conducted on dielectrics of the following types: Quartz, ST-10, Fluoroplastic-4 [Soviet equivalent of teflon], and Polystyrene. An analysis of the results of measuring ϵ as compared with data obtained on standard units made it possible to conclude that the relative error of measurement of ϵ is not more than $\pm 2\%$. The proposed method is simple and is convenient for checking ϵ with commercially produced dielectrics and products made from them. Figures 1; references: 2 Russian.

6415/9716

CSO: 1860/243

POWER GYROTRON FOR THIRD HARMONIC OF A CYCLOTRON FREQUENCY

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 31, No 2, Feb 86 (manuscript received 29 Mar 84) pp 334-336

[Article by S.A. Malygin]

[Abstract] The possibility in principle of effective operation of cyclotron resonance lasers, in particular gyrotrons (firm name for vibrating gyroscope), for the harmonics of cyclotron frequency is known. However, in proportion to an increase of the number of harmonics, realization of power devices becomes increasingly more difficult. In connection with this fact experimental investigations were made of a gyrotron operating at the third harmonic of cyclotron frequency. The experiments bore witness to the effective selection of vibrations in gyrotrons containing a system of combined resonators with mode transformations, making it possible to realize stability of single-mode vibrations at the third harmonic of the gyro frequency. Suppression of the parasitic vibrations in the relatively high-Q output resonator is connected with preliminary energy modulation of the electron beam by an operating type field in the input resonator. At the same time excitation of the interfering modes in the input resonator is practically excluded because of its small length and Q-factor. Optimization of the electron-optical and electrodynamic systems would assist an increase of the efficiency. The pulse output power of the generator reached 150 kW at a 5.6-mm wavelength with an efficiency of $\sim 100\%$. The author thanks Sh.Ye. Isimring and V.Ye. Zapevalov for attention to the work and for assistance. Figures 4; references 9: 8 Russian, 1 Western.

6415/9716
CSO: 1860/241

SIMILARITY LAWS FOR RELATIVISTIC AND NONRELATIVISTIC O-TYPE ELECTRON-WAVE SYSTEMS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 31, No 2, Feb 86 (manuscript received 20 Dec 84) pp 413-416

[Article by N.L. Romashin and V.A. Solntsev]

[Abstract] The article is concerned with the construction of similarity laws for O-Type electron-wave systems, with the aid of which it is possible with a controlled error directly to employ an experiment for creation and investigation of nonrelativistic systems for their relativistic analogs. A relativistic dimensionless nonlinear system of equations for O-Type electron-wave systems is obtained. Figures 2; references: 6 Russian.

6415/9716
CSO: 1860/241

UDC 621.316.56.3.064.43

PROCESS OF GAP FORMATION BETWEEN CONTACT SURFACES IN EXPLOSION-TYPE CIRCUIT BREAKERS

Novocherkassk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ELEKTROMEKHANIKA in Russian No 1, Jan 86 (manuscript received after revision, 29 Jan 85) pp 81-87

[Article by Valeriy Leonidovich Korolkov, candidate of technical sciences, senior scientific associate, Aleksandr Yefimovich Nesterenko, graduate student, and Aleksandr Anatolyevich Sivkov, candidate of technical sciences, senior scientific associate, Scientific Research Institute of High Voltages, Tomsk Polytechnic Institute]

[Abstract] The process of gap formation between contacts in a circuit breaker with an explosion mechanism is analyzed on the basis of energy relations in such a device, which essentially consists of two stationary current-carrying electrodes bridged by a tubular fuse inside a tightly sealed hollow cylinder made of an insulating material. The fuse is a thick-walled tube with an explosive charge at the center and an arc-quenching substance, usually transformer oil, filling the space inside. Grooves cut lengthwise around its outside surface reduce the amount of energy necessary for blowing it up. An air cushion along the inside surface of the cylindrical enclosure allows for movement after the explosion. Motion of the fuse under pressure of the shock wave following the explosion produces the gap, in three stages. First the fuse expands till it ruptures along the grooves, then its fragments continue moving until the entire air cushion has been replaced with the arc-quenching transformer oil, whereupon they move through that oil. The energy relations during gap formation by this mechanism are established with the aid of experimental data supplementing the general laws, taking into account the explosion dynamics with shock wave propagation and reflection as well as the arc-quenching kinetics in the given configuration. A semiempirical expression is thus obtained for the pressure on the fuse

$$P = 10^7 (0.018 - 0.031 s_0 / s_T) \dot{r} e^{0.0026 \dot{r} (s_0 / s_T) - 0.075} \quad (s_0 - \text{lateral surface area of fuse prior to rupture, } s_T - \text{area of gaps between its parts after rupture, } r - \text{outside radius of fuse prior to rupture, } \dot{r} - \text{velocity of fuse parts after rupture. Figures 3; tables 1; references: 6 Russian.}$$

2415/9716

CSO: 1860/211

MAXIMUM VELOCITY OF FERROMAGNETIC ARMATURE IN ONE-SHOT ELECTROMECHANICAL ENERGY CONVERSION

Novocherkassk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ELEKTROMEKHANIKA in Russian No 1, Jan 86 (manuscript received 11 Nov 84) pp 91-94

[Article by Viktor Vasilyevich Ivashin, doctor of technical sciences, professor, and Igor Aleksandrovich Miloradov, candidate of technical sciences, assistant professor, Togliatti Polytechnic Institute]

[Abstract] The acceleration of a ferromagnetic armature during one-shot operation of an electromechanical energy converter is analyzed from the standpoint of performance and design. The general energy-force-displacement relations applicable to all such devices, where motion of the armature causes the gap volume to decrease and the gap permeance to increase, are formulated for the specific simple case of a bar armature moving transversely through the magnetic field between two poles of a shell-type inductor. Calculations confirm that the work done by such a converter with a given magnetic induction within the interaction space cannot exceed the energy of a magnetic field with the same induction within a volume of nonmagnetic medium equal to the volume of the armature. While the ratio of produced mechanical energy to armature weight reaches its maximum as the relative width of the armature approaches zero, maximum mechanical energy is produced with an armature half as wide as the gap. Letting the magnetic induction in the gap be the maximum possible, corresponding to the saturation induction B_s in the armature iron, the maximum velocity to which an armature with a relative width $b = 0.5$ can be accelerated is $v = 10B_s$ or 15-20 m/s ($B_s = 1.5-2$ T). Higher velocities require multistage acceleration, velocities attainable by motion across a magnetic field being generally higher than those attainable by motion parallel to the magnetic field. Figures 2.

2415/9716

CSO: 1860/211

INVESTIGATION OF DAMPING PROPERTIES OF ELECTRIC DRIVE OF ICE-BREAKER PROPELLER

Novocherkassk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ELEKTROMEKHANIKA in Russian No 4, Apr 86 (manuscript received 9 Oct 85) pp 107-110

[Article by Sergey Vladimirovich Bykov, candidate of technical sciences, senior scientific-research worker, Leningrad Higher Engineering Maritime School imeni Admiral S.O. Makarov]

[Abstract] A theoretical analysis, mathematical modeling, and experimental investigations demonstrate the possibility of a significant increase of the damping properties of the electric drive of an ice-breaker propeller which leads to a decrease of the dynamic loads on all the elements of the propulsive complex and an increase of their service life. The proposed regulators,

which increase the damping properties of the electric drive, have been introduced on powerful arctic ice-breakers. Figures 2; references: 4 Russian.

6415/9716

CSO: 1860/260

UDC 621.316.542.027.3-186.2:537.51

INVESTIGATION OF DIELECTRIC STRENGTH OF HIGH-VOLTAGE VACUUM ARC BLOWOUT CHAMBERS AFTER CURRENTLESS COMMUTATION

Moscow ELEKTROTEKHNIKA in Russian No 3, Mar 86 (manuscript received 22 Jan 85) pp 38-40

[Article by Ye.A. Shokhin, engineer, and M.Ye. Danilov, candidate of technical sciences, All-Union Electrotechnical Institute imeni V.I. Lenin]

[Abstract] The dielectric strength was investigated of the intercontact interval of the contact system of a vacuum arc blowout chamber (ABC) at 35 kV, after currentless commutation with increased voltage. The investigations were conducted on a knock-down model of a high-voltage ABC which consisted of a metal vacuum-type tank, a high-voltage lead-in at 300 kV, and a system of electrostatic shields. The metal tank has two optical openings which make it possible simultaneously to conduct optical as well as electrical investigations. The complex dependence is shown of the breakdown voltage of the ABC after currentless commutations as a function of the speed of encounter of the contacts and the distance between them. Figures 4; references 12: 5 Russian, 7 Western (1 in Russian translation).

6415/9716

CSO: 1860/239

UDC 669.187.012

UTILIZATION OF SECONDARY ENERGY SEPARATION IN FERROALLOY ELECTRIC FURNACES

Moscow ELEKTROTEKHNIKA in Russian No 3, Mar 86 (manuscript received 27 May 85) pp 20-23

[Article by V.L. Rozenberg, candidate of technical sciences, L.A. Ryazantsev, engineer, A.G. Lykov, A.S. Polyakov, and A.G. Lunin, candidates of technical sciences]

[Abstract] Ferroalloy electric furnaces (FEF) are the most common type of ore-smelting furnaces in use at ferrous metallurgy enterprises for production of ferroalloys and silicon. Investigations of the operating conditions of such furnaces with a power of 16.5-63.0 megavolt-amperes demonstrated that they are a powerful source of secondary thermal energy, the use of which makes it possible to decrease the overall energy expenditures and to reduce the effect of the operation of furnaces on the environment. Data from the literature are analyzed and the prospects for utilization of the secondary energy

are discussed. A number of methods for its utilization, both in the technological process itself and outside the furnace for the energy requirements of other users, are presented. References 24: 20 Russian, 4 Western.

6415/9716

CSO: 1860/239

UDC: 551.46.01

TRANSFORMATION AND UTILIZATION OF HEAT ENERGY RESOURCES OF THE OCEAN

Minsk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ENERGETIKA in Russian No 2, Feb 86 pp 3-9

[Article by A.K. Ilyin, candidate of technical sciences, assistant professor, Pacific Institute of Oceanography]

[Abstract] The power of heat energy resources available in the temperature difference between surface and deep water in the tropical regions of the ocean is not over 11 billion kw, 0.016% of the power received by the earth in solar energy. The more realistic energy potential considering heat losses of probable designs is 6 to 7 billion kw, which is comparable to the total world consumption of electric power at the present time. It is more difficult to estimate the potential of Arctic heat energy power plants. The available power tropical plants can be increased by additionally utilizing solar energy to heat the surface water above its natural temperature, thus increasing the heat difference between surface and deep water available for power generation. American plans for tropical power plants are mentioned. The significance of ocean power plants is increased if they are looked upon not as simple power plants but also as plants producing large quantities of liquid and gaseous hydrogen and ammonia as well as fresh water. Figures 4, references 7: 5 Russian, 2 Western.

6508/9716

CSO: 1860/225

UDC: 621.311.16:658.155.015.2

ESTIMATE OF LOSS FROM VARIATIONS OF VOLTAGE IN COMMERCIAL POWER NETWORKS

Moscow PROMYSHLENNAYA ENERGETIKA in Russian Vol 15, No 1, Jan 86 pp 16-17

[Article by V.A. Otsepkov, engineer, Sibenergotsvetmet Production Association]

[Abstract] An equation is presented for calculation of the costs resulting from variations of the voltage in commercial lighting networks from the nominal voltage, including the cost of replacement of lightbulbs. Calculations indicate that the loss due to overvoltages is largely compensated by savings achieved with undervoltages. Figure 1, references: 4 Russian.

6508/9716

CSO: 1860/218

INCREASING THE EFFECTIVENESS OF UTILIZATION OF ENERGY RESOURCES AT LIGHT INDUSTRY ENTERPRISES

Moscow PROMYSHLENNAYA ENERGETIKA in Russian No 1, Jan 86 pp 6-7

[Article by E.A. Ezekyan, engineer, USSR Light Industry Ministry]

[Abstract] During the 11th Five-Year Plan, some 992 obsolete boilers were replaced, 194 small and uneconomical boilers were shut down with consumers switched to centralized heat supplies and 120 boiler shops were switched to gas. Electric power networks were redesigned at 368 enterprises. Some 13,800 electric meters were installed. Each year, as many as 100 enterprises take part in the All-Union competition for best energy savings suggestions. Organizational and technical measures of this sort have achieved a savings of some 500,000 tons of fuel, 2.5 million Gcal of heat and 950 million kw·hr of electric power during the 5-year plan. However, there is still a tendency toward increased power consumption per unit of output in light industry.

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UDC: 621.311.1.004.18

RESULTS OF FORTIETH ALL-UNION COMPETITION FOR BEST SUGGESTIONS FOR SAVING ELECTRICAL AND HEAT ENERGY

Moscow PROMYSHLENNAYA ENERGETIKA in Russian Vol 15, No 1, Jan 86 pp 8-10

[Article by V.P. Nuzhin, chairman, All-Union Competition Jury, and I.M. Fetisova, Executive Secretary, All-Union Competition Jury]

[Abstract] The Fortieth All-Union Competition called forth 1,651 suggestions with a total economic effect of 2.3 million kw·hr electric power, 2.7 million Gcal heat energy. Workers in the metallurgy, chemistry, petrochemistry and oil refining, motor vehicles, light and textile industries were most active. The jury awarded prizes to the 205 best suggestions. First prize went to workers at Nizhnekamskneftekhim Production Association, Lenneftekhim Scientific Production Association and the Voronezh Branch of Giprokauchuk for a suggestion entitled "Development and introduction of energy savings technology for production of isoprene in the production of synthetic rubber using KBF-76 catalyst." The suggestion has yielded an annual savings of 141,700 Gcal of heat energy. Other award winning suggestions included "Improvement of the design of KTJ-12.5/35 centrifugal compressor," suggestions for improvement of technological processes for working of motor vehicle parts, "Study and introduction of operating conditions of PT-60-130/13 turbines with nominal steam consumption in the high pressure section and minimum ventilation throughput of steam in middle and low pressure sections with middle pressure section valves completely closed," and a suggested change in the technological process of producing blister copper. The Forty-First All-Union Competition for best suggestion for savings of energy will be held in 1986.

6508/9716

CSO: 1860/218

ACCELERATE PROGRESS

Moscow ELEKTROTEKHNIKA in Russian No 1, Jan 86 pp 3-7

[Article by G.P. Voronovskiy, Minister of Electrotechnical Industry]

[Abstract] Following its achievements and contributions to the national economy in the 11th Five-Year Plan, the electrotechnical industry will have to overcome many deficiencies in planning and management in order to meet its goals in the 12th Five-Year Plan. This will require better organization and discipline, more responsibility and more creative initiative at all levels. High priority has been assigned to boosting the manufacture of electrical machinery, a 39.1% increase of the production volume with a 46.2% higher productivity and an 11.3% lower unit manufacturing cost. This machinery will include a standard series of 63-800 MW turbogenerators as well as 1000 MW turbogenerators for atomic electric power plants. Other priority items are more reliable control of nuclear power, more efficient and economical distribution of electric energy over 1150 kV a.c. and 1500 kV d.c. transmission lines, updating mechanization and automation of industrial processes, including introduction of robotized flexible production systems, supplying more and better electrical equipment to the major industrial customers such as the metallurgical industry with a great need for electric-arc furnaces, the railroad transportation industry, the machine tool manufacturing industry, the agricultural industry, and many others like electroplating plants and electric welding plants. Special-purpose technological equipment is to be produced at a 228% faster rate than in the 11th Five-Year Plan. The economic impact of the 12th Five-Year Plan and the next two is to equal that of all the preceding ones since the Soviet Union was established. This will require better collaboration of the scientific community, best achieved by expanding the scientific-industrial associations, and recognition of this industry's role in meeting the objectives of the CPSU. One objective is to double the national income and the overall industrial output so as to also double the amount of available consumer goods during the 12th Five-Year Plan period.

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CSO: 1860/212

UDC 621.313.322-81:621.039

PLANNED ELECTRICAL EQUIPMENT FOR ELECTRIC POWER PLANTS

Moscow ELEKTROTEKHNIKA in Russian No 1, Jan 86 (manuscript received 27 Jun 85) pp 7-9

[Article by I.A. Glebov, academician, USSR Academy of Sciences]

[Abstract] Progress made so far in generator construction is evidenced by the many different machines already built and in operation, ranging from the 1200 MW - 3000 rpm turbogenerator in the Kostrom atomic electric power plant

to the totally enclosed 30 MW - 62.5 rpm hydroelectric generators in several hydroelectric power plants. In order to make further progress in the next 10-15 years, it will be necessary to solve a number of technical problems. Turbogenerators to be built in the next 10-15 years will have to be more reliable. This, according to international practice, is achieved principally by lowering and stabilizing temperature rises and vibration levels. The rule is that at least two prototypes of a new design must be shown to be approximately as reliable as the existing standard series. An analysis of the state of the art in the USSR indicates that here reduction of wear and tear is the principal factor, facilitating repairs and streamlining the overhaul procedure being an important design consideration. Application of microprocessor and computer technology to trouble shooting will also play a significant role in reliability assurance. The power rating of turbogenerators for thermal electric and atomic electric power plants should be extended to 1500 MW, this being achievable by utilization of technology but with better materials: low-loss nonoriented electrical steel and electrical insulation with 5 kV/mm strength. Other design features should include hollow copper conductors, use of new highly effective materials for vibration damping, use of nonmagnetic corrosion-resistant alloys for reinforcement of rotating parts, and use of full liquid cooling. Hydroelectric generators built in the next 10-15 years will include those with higher power ratings within the 500-1000 MW range and those with lower power ratings for plants on small rivers. Hydroelectric generators for installation in Siberia will be generally low-speed machines, just as those installed now, but their voltage ratings should be increased up to 20 kV so as to allow a more efficacious design of such inherently large-size machines. Under consideration are also medium-power (300-400 MW) medium speed (300-500 rpm) generator-motor units for pumped-storage hydroelectric power plants. References: 5 Russian.

2415/9716

CSO: 1860/212

UDC 621.315.05.004.15

TECHNICAL AND ECONOMIC BASIS FOR SELECTION OF VOLTAGE CLASS ABOVE 1150 kV FOR FUTURE A.C. ELECTRICAL TRANSMISSION LINES

Moscow ELEKTROTEKHNIKA in Russian No 1, Jan 86 (manuscript received 8 Aug 85) pp 33-36

[Article by G.A. Apostolatov, candidate of technical sciences, and N.N. Sokolov, engineer, All-Union Institute of Electrical Engineering imeni V.I. Lenin]

[Abstract] While the 1150 kV voltage class was adopted in the 11th Five-Year Plan for construction of new overhead a.c. electric transmission lines, this voltage level being 1.5 times higher than that of the preceding 750 kV class, technical and economic evaluation of the next higher voltage class was begun for adoption in the 12th Five-Year Plan. Theoretical calculations leading to optimum selection of the voltage class within the 1200-2500 kV range are based on the trinomial equation for equipment cost K (rubles/m) = $a_1 + a_2 V^n + a_3 S^m$ (V - voltage (kV), S - conductor cross-section area (mm^2), a_1, a_2, a_3, n, m - design

parameters). Calculations were made for $n = \text{var} = 10-20$ and $n = \text{const} = 24$ split conductors/phase. Equipment was to include autotransformers, distributors, reactors, compensators, protective relaying, KRUE circuit breakers, and substation auxiliaries. The technical criterion was maximum efficiency and the economic criterion was minimum cost/(kW·h). Although ideally the voltage level should be doubled, 1800 kV was found to be the optimum next higher voltage class for the coming 10-15 years. Nominal 1800 kV allows 1900 kV, approximately 5% higher, maximum operating voltage. This choice was based on limiting internal overvoltages to 140% and overvoltages caused by lightning surges to 160%, also use of thyristor-type static compensators and gas-filled circuit breakers. This choice of voltage class does not preclude the possibility that a higher voltage level within the 2200-2500 kV may eventually be found to be preferable. Figures 6; tables 4; references: 2 Russian.

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CSO: 1860/212

UDC 621.315.21.001.1

OUTLOOK FOR DEVELOPMENT OF POWER CABLE PRODUCTION

Moscow ELEKTROTEKHNIKA in Russian No 1, Jan 86 (manuscript received 30 May 85) pp 43-47

[Article by Yu.V. Obratstov, candidate of technical sciences, and I.B. Peshkov, doctor of technical sciences, professor, All-Union Scientific Research Institute of the Cable Industry]

[Abstract] Power cable production within the USSR Power Development Program for the 1985-2000 period will cover conventional oil-filled cables upgraded for 110-500 kV voltages and new cables with thermoplastic insulation, special underwater cables for off-shore oil drilling, and special cables for atomic electric power plants, also better than existing power distribution cables in the 1 kV voltage class. The attainment of these objectives will depend largely on theoretical and experimental studies made at the All-Union Scientific Research Institute of the Cable Industry. Considering that temperature characteristics and aging of the insulation are the basic factors determining cable design and performance, a model of a two-layer graded insulation system and thermal decomposition as principal aging mechanism has been developed for 110-220 kV oil-filled cables operating in electric fields of up to 15 MV/m intensity with adequate overload capacity. Cables of this type with not more than 7-15 mm thick insulation have already been built and tested for urban power distribution networks with negligible exposure to lightning strokes. Thermoplastic insulation, specifically cross-linked (vulcanized) polyethylene, is preferable to oil not only because of higher allowable operating temperature and lower allowable ambient temperature, also lower dielectric loss tangent, but also because of its much lower cost: typically 106.4 rubles/(MVA·km) of thermoplastic-insulated cable as compared with 365 rubles/(MVA·km) of oil-filled cable. A model based on treeing as principal aging mechanism has been developed for thermoplastic-insulated cables with not only the intensity but also the frequency of the electric field determining the insulation life.

Underwater cables with such an insulation rated for 35 kV have already been built and tested. Cables for atomic electric power plants require not only nonflammable and slow-burning insulation but also radiation-resistant and corrosion-resistant cladding for normal operating temperatures up to 150°C and immune to "standard fire" with 750°C for 1.5 h. Such cables have been built and are now tested according to the most stringent IEC specification No 332-3-1982 category A. They contain impregnated paper with an oxygen index of 22-26 (percentage of oxygen in oxygen-nitrogen mixture which sustains combustion) as insulation. Their cladding is made of aluminum sheet with one layer of refractory bituminous compound + one layer of dacron tape + one layer of unimpregnated fiberglass. These cables are enveloped by protective armor of galvanized steel. Figures 6; tables 1; references: 2 Russian.

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UDC 621.7.004.18

MEANS OF SAVING FUEL-ENERGY RESOURCES AT A MACHINE BUILDING PLANT

Moscow PROMYSHLENNAYA ENERGETIKA in Russian No 3, Mar 86 pp 2-3

[Article by P.Sh. Kapachunskiy, V.B. Nizimov and Ye.D. Khmel'nitskiy, candidates of technical sciences, Dneprodzerzhinsk Industrial Institute imeni M.I. Arsenichev]

[Abstract] An analysis was made of the consumption of fuel-energy resources at the Dnepropetrovsk Metallurgical Equipment Plant. Norms for the expenditure of electrical energy and fuel in the plant's principal production are presented. The principal organization-technical measures with respect to a reduction of specific norms for consumption of fuel-energy resources at the plant include: 1) A rational organization for maintenance of induction furnaces at night and on holidays (because even when idle an electric furnace consumes approximately 150 kW hours of energy); 2) Introduction of progressive technology for drying forms of carbonic acid gas; 3) Regulation of the operating conditions of ventilators and exhaust fans and the equipment of their electric motors with two stages of the rotation frequency; 4) Introduction of the VMG-5000 multioperator welding unit; and 5) Use of controlled excitation of synchronous drives with thyristor converters which increases the power factor of the electric power supply at an enterprise.

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CSO: 1860/240

4MT(K)F112 AND 4MT(K)FL32 CRANE MOTORS

Moscow PROMYSHLENNAYA ENERGETIKA in Russian No 3, Mar 86 pp 46-47

[Unsigned article]

[Abstract] 4MT(K)F112 and 4MT(K)FL32 (Class F insulation) crane motors are intended for the drive of cranes and other general purpose mechanisms, the operation of which is characterized by short-time and repeated short-time regimes, as well as large ratios of overloading. 4MT(K)H112 and 4MT(K)H132 (Class H insulation) motors are intended for metallurgical production drives as well as other drives operating in increased temperature of the environment. The motors are designed to operate from 3-phase alternating current networks at 220/380 volts with a 50 Hz frequency. (For customer requirements motors are manufactured which use other standard voltages up to 660 V at 50 and 60 Hz frequencies.) A number of other motors are also considered. Technical data for motors with Class F and H insulation heat resistance are presented in a table. The manufacturer of the 4MT(K)112 motor is the Bavlenskiy Electromechanical Plant, Vladimir Oblast, and that of the 4MT(K)132 is the Electrical Motor Plant, Tbilisi.

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UDC 621.316.542.027.2.004.1

TYPE VP-701 LIMIT SWITCHES

Moscow PROMYSHLENNAYA ENERGETIKA in Russian No 3, Mar 86 pp 47-48

[Unsigned article]

[Abstract] The article describes Type VP-701 limit explosion-protected oil filled switches intended for switching of electric control and signalling circuits of alternating current in the drive of periodically operating mechanisms with an automatic or semiautomatic cycle. The switches are used in stationary installations. In the conventional designation VP-701/1 Exd11T6X2 [Exd is in the Latin alphabet] VP = Limit switch; 701 = number of series; /1 = arrangement indicator as viewed from the reductor (with an arrangement indicator as viewed from the opposite reductor, the digit is absent); 1 = explosion-safety of electrical equipment; Ex = correspondence to explosion-protection standard; d = oil filling of casing; 11 = group of electrical equipment; T6 = temperature class; X2 = climatological use (Y, T) and class of location (2) with respect to GOST 15150-69 and GOST 15543-70. The manufacturer of the switch is the Electrical Equipment Plant in Zelenokumsk.

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CSO: 1860/240

UDC 681.2:537.7

DIFFRACTION OF LIGHT AT RECTANGULAR APERTURE WITH STATISTICALLY UNEVEN EDGE

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST in Russian No 12, Dec 85
(manuscript received 18 Feb 85) pp 10-12

[Article by S.P. Sakhno and G.S. Tymchik]

[Abstract] Using a Fourier optical approximation, the paper studies the diffraction of coherent radiation at a rectangular aperture with a statistically uneven edge. The results of the investigation can be used during analysis of equipment functions of coherent optical spectrum analyzers and Schlieren [shadowgraph] devices (Foucault knife type), as well as during the development of devices intended for checking the state of a cutting tool and the quality of metal working of units under conditions of flexible automated production. Figures 2; references 10: 9 Russian, 1 Western.

6415/9716
CSO: 1860/166

UDC 681.785.5

DISPERSING SYSTEMS WITH CONSTANT MERIDIAN INCREASE IN BOUNDARIES OF LARGE ANGULAR FIELD

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST in Russian No 12, Dec 85
(manuscript received 15 Jul 85) pp 13-14

[Article by V.V. Afanasyev, N.I. Glebkova and V.B. Shlishevskiy]

[Abstract] New dispersing systems are analyzed in which the meridian increase in the limits of a large angular field remains practically constant in a sufficiently wide spectral range. Retention of the constant increase is assured by a mechanism for matching the angles of rotation of a reflecting diffraction grating and an autocollimated mirror in an installation with two-fold diffraction. Some partial versions of the systems considered exist in a 1984 paper by Yu. V. Markin, but the principles and characteristics of their composition were unclear. Figures 3; references 13: 12 Russian, 1 Western.

6415/9716
CSO: 1860/166

CALCULATION OF ENERGY CONCENTRATION IN POLYCHROMATIC IMAGE OF AN OBJECT WITH FINITE DIMENSIONS, PRODUCED BY DIFFRACTION-BOUNDED OPTICAL SYSTEM

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST in Russian No 12, Dec 85
(manuscript received 21 Dec 84) pp 15-17

[Article by I.V. Peysakhson and T.A. Cherenko]

[Abstract] A program for the BESM-6 computer is created for use in a study of the distribution of illumination intensity and the energy concentration in the image of an object produced by a nonaberrational optical system operating in a wide spectral region. The numerical integration in expressions for the polychromatic optical transfer function (OTF) and the energy concentration function (ECF) is accomplished by the Simpson method. Graphs are shown of the ECF: 1) Obtained during a calculation in monochromatic light and with a triangular distribution of the actinic flux; 2) With linearly increasing distribution of the actinic flux; and 3) Obtained during calculation in the spectral region $\lambda_0 + 0.5 \lambda_0$ with various distributions of the actinic flux. Figures 3; tables 2; references 3: 1 Russian, 2 Western in translation.

6415/9716

CSO: 1860/166

UDC 535.813.002.2

PRODUCTION OF OPTICAL ELEMENTS FROM POROUS GLASS

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST in Russian No 12, Dec 85
(manuscript received 8 May 85) pp 22-24

[Article by I.K. Meshkovskiy, S.S. Solovyev and V.Ye. Stepanov]

[Abstract] The paper studies the processes involved in production-process annealing of material as well as the essentials of the technology for manufacturing optical parts of porous glass, a characteristic of which is the use of two-stage thermal treatment of material, with the object of stabilizing the structure, properties, and cleansing of porous materials of organic compounds. Figures 2; references 6: 5 Russian, 1 Western.

6415/9716

CSO: 1860/166

APERTURE SYNTHESIS OF ASTRONOMICAL TELESCOPES

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST in Russian No 12, Dec 85
(manuscript received 17 June 85) pp 32-38

[Article by N.A. Dimov]

[Abstract] The paper is concerned with aperture synthesis development in connection with the creation of astronomical telescopes which combine a large light-collection area with high resolution. The following items are considered: 1) The two main approaches at present to the problem of aperture synthesis of astronomical telescopes; 2) Telescopes with compound principal mirror; 3) Synthesis of partly filled aperture; and 4) Alignment and phasing of optical systems of aperture synthesis. The limitations connected with atmospheric turbulences are noted and possible means are considered for decreasing their effect with the use of certain systems of aperture synthesis. Figures 13; references 41: 10 Russian, 6 Western in translation; and 25 Western.

6415/9716

CSO: 1860/166

UDC 621.338

CONSIDERATION OF EFFECT OF STORED CHARGE IN SEMICONDUCTOR LASER DURING FORMATION OF CLOSELY ARRANGED PULSES OF STIMULATED RADIATION

Leningrad IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: PRIBOROSTROYENIYE in Russian Vol 29, No 4, Apr 86 (manuscript received 9 May 84) pp 82-84

[Article by K.N. Korostik, Belorussian State University imeni V.I. Lenina]

[Abstract] GaAlAs lasers on a double heterostructure with strip-line geometry of the ohmic contact were investigated. The lasers were excited by means of a generator of twin pulses of current, making it possible to regulate the interval between pulses and the amplitude of each pulse separately. The possible effects are considered of the stored charge during formation of a sequence of light pulses with prescribed parameters by varying the parameters of the pulses of the exciting current. The article is recommended by the Department of Quantum Radio Physics and Optoelectronics. Figures 1; references: 2 Russian.

6415/9716

CSO: 1860/263

MONOCHROMATIC OPTICAL SYSTEMS WITH HIGH RESOLUTION

Leningrad IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: PRIBOROSTROYENIYE in Russian Vol 29, No 4, Apr 86 (manuscript received 10 Jan 85) pp 85-88

[Article by G.L. Nikiforova, Leningrad Institute of Precision Mechanics and Optics]

[Abstract] Various methods of designing monochromatic optical systems are considered. In connection with the use of lasers in various areas of science and technology, e.g., for optical recording and readout of information, a modular principle is proposed for the design of objectives with a diffraction image quality. The principal optical scheme of a high-resolution monochromatic objective for a laser pickup with a numerical aperture $A = 0.45$, focal distance $f' = 4.3$ mm, linear field $2y = 0.1$ mm, effective wave length of laser $\lambda = 0.78$ micrometer is presented, as well as the results of calculations. The article is recommended by the Department of the Theory of Optical Instruments. Figures 1; references: 4 Russian.

6415/9716

CSO: 1860/263

UDC 621.384.3

EVALUATION OF THRESHOLD DIFFERENCE OF TEMPERATURE OF INFRA-RED IMAGING DEVICES

Leningrad IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: PRIBOROSTROYENIYE in Russian Vol 29, No 4, Apr 86 (manuscript received 16 May 85) pp 89-91

[Article by V.I. Matveyev, Moscow Higher Technical School imeni N.E. Bauman]

[Abstract] A 1978 article (D. Lloyd, Infra-Red Imaging System, Moscow Higher Technical School imeni N.E. Bauman) obtained an expression for the threshold differences of the temperature ΔT_p , which is one of the generalized criteria of the quality of infra-red imaging devices. However, in the derivation of an expression for ΔT_p , the effect on the signal-to-noise ratio of differences in the emissive power of objects was not taken into account, although a change of the emissive power $\Delta \epsilon$ can lead to a significant error in determining ΔT_p , particularly in the case of low-temperature objects. In the present article an analytical expression is obtained for the threshold difference of the temperature ΔT_p with allowance made for changes of the emissive power of objects and the effect of $\Delta \epsilon$ on ΔT_p is evaluated for typical operating conditions on infra-red imaging devices. The article is recommended by the Department of the Elements of Instrument Devices. Figures 1; references 3: 2 Russian, 1 Western.

6415/9716

CSO: 1860/263

OPERATING MODES OF CRYOTRON CONTROLLED BY RADIATION FROM HETEROJUNCTION LASER

Leningrad IZVESTIYA VYSSHIKH UCHEBNIKH ZAVEDENIY: PRIBOROSTROYENIYE in
Russian Vol 28, No 12, Dec 85 (manuscript received 15 Oct 84) pp 59-61

[Article by O.G. Vendik, A.Ya. Zayonchkovskiy, S.G. Kolesov and L.L. Tereshenko,
Leningrad Electrotechnical Institute imeni V.I. Ulyanov (Lenin)]

[Abstract] A thin-film cryotron controlled by the radiation from a hetero-junction laser is examined. A niobium film $0.2 \mu\text{m}$ thick applied by cathode sputtering in a vacuum on a polished sapphire substrate is employed. The radiation source is a $0.5 \mu\text{m}$ heterojunction laser, from which the radiation is fed to the irradiated portion of the film to a quartz light guide. The response of the superconducting structure to impulse radiation from the hetero-junction laser is investigated experimentally with small current passing through the film. The experiments indicate that stability of the film resistance of $\pm 3\%$ under normal conditions stabilizes the laser supply current to within $\pm 1 \text{ mA}$, which corresponds to stabilization of the output power to within $\pm 0.05 \text{ mW}$. Figures 3, references: 5 Russian.

6900/5716

CSO: 1860/165

NOISE TOLERANCE OF AMPLITUDE-PHASE MODULATED OPTOELECTRONIC SYSTEMS IN PRESENCE OF INTERNAL RECEIVER NOISE AND SPATIAL CLUTTER

Leningrad IZVESTIYA VYSSHIKH UCHEBNIKH ZAVEDENIY: PRIBOROSTROYENIYE in
Russian Vol 28, No 12, Dec 85 (manuscript received 4 Feb 85) pp 62-67

[Article by V.A. Kazakov and S.A. Afrikanov, Ryazan Radiotechnical Institute]

[Abstract] The noise tolerance of optoelectronic measurement systems are analyzed under dynamic, nonlinear conditions on the basis of Markov nonlinear filtering of continuous processes. The statistical characteristics of the background clutter are analyzed, and the accuracy of determining the coordinates of the object is assessed. The variance of the filtering error of the coordinates of a stationary isotropic Gaussoidally correlated background is analyzed by computer as an example. The findings agree well with the conclusions reached in other studies, indicating that the proposed method can be used to calculate the noise tolerance of amplitude-phase optoelectronic systems in the presence of moving random backgrounds. The use of nonlinear filtering theory makes it possible to allow for continuous, as well as abrupt, changes in the characteristics of the object in the background. Figures 5, references 9: 8 Russian, 1 Western.

6900/9716

CSO: 1860/165

ANALYSIS OF PHASE-TYPE OPTOELECTRONIC IMAGE MOVEMENT RATE STABILIZER BASED ON MULTIELEMENT RADIATION DETECTOR

Leningrad IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: PRIBOROSTROYENIYE in Russian Vol 28, No 12, Dec 85 (manuscript received 12 Oct 84) pp 67-73

[Article by I.N. Kondaurov and V.A. Solomatín]

[Abstract] Two versions of phase-type image movement rate stabilizers are examined: One in which the elements in the radiation detector are switched sequentially (row by row) and one in which a raster consisting of bands of equal width are implemented on a multielement detector. The operation of the stabilizers is analyzed, and their accuracy is assessed. Formulas are derived for the signal spectrum and the image movement rate measurement error for the two scanning methods. The rate measurement error due to internal noise is smaller by a factor of (N/π) for the "band" raster than for element-by-element sampling under otherwise equal conditions. Figures 4, references 2: 1 Russian, 1 Western.

6900/9716
CSO: 1860/165

UDC 681.2(520)

SELECTION OF OPTIMAL DEVICE STRUCTURE CONSIDERING MEASUREMENT SIGNIFICANCE CRITERION

Leningrad IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: PRIBOROSTROYENIYE in Russian Vol 28, No 12, Dec 85 (manuscript received 11 Jun 84) pp 73-79

[Article by P.P. Kuzmin, N.N. Lyashenko and N.A. Fedukova, Leningrad Water Transport Institute]

[Abstract] This study addresses the selection of the optimal structure for a measurement system by taking into account the factors that influence measurement accuracy and limiting their number. The optimal structures are found by identifying the set of variables to which the lowest measurement cost for given accuracy corresponds, identifying the set of variables that provides the best measurement accuracy for a given cost, and finding the set of variables that minimizes the risk function $H(s, \sigma)$, where s is the measurement cost, and σ is the standard deviation. These problems are solved by finding the relationship between the standard deviation σ and the selected set of factors. The structure of an optoelectronic angle measuring instrument is analyzed as an example. The proposed measurement significance criterion is found to be one of the basic indicators that characterizes a device, and can be used to find the optimal structure and to select the technical treatments that govern its construction. Figures 2, tables 1.

6900/9716
CSO: 1860/165

SOME RESULTS OF INVESTIGATION OF TRANSVERSE FOCUSING ERROR

Leningrad IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: PRIBOROSTROYENIYE in Russian Vol 28, No 12, Dec 85 (manuscript received 5 Oct 84) pp 79-83

[Article by S.M. Latyev and A.A. Solovyeva, Leningrad Institute of Precision Mechanics and Optics]

[Abstract] Studies are described that were conducted to obtain data for calculating the component of the probable error of an optical instrument (such as the practical limiting error) due to transverse focusing error: The scattering distribution of the error, the occurrence of systematic components of the error and their causes, and factors that cause the amount of the error to change as the device is operated. The studies were performed on an optical system in which the alignment error of two grids was measured by a micron gauge during repeated re-focusing. The effect of the type of light filter, illumination, aberration, and direction of alignment were investigated. The calculation of the error is explained, and recommendations are given for reducing the error. Figures 4, tables 1, references: 5 Russian.

6900/9716

CSO: 1860/165

UDC 621.375.826:621.785.616

CO₂ LASERS FOR THERMAL HARDENING OF STEEL AND CAST IRON

Moscow ELEKTROTEKHNIKA in Russian No 3, Mar 86 (manuscript received 27 May 85) pp 5-7

[Article by A.S. Borodachev and M.B. Gutman, candidates of technical sciences; G.K. Rubin, doctor of technical sciences, and L.A. Medvedovskaya, candidate of technical sciences, All-Union Scientific-Research Institute of Electro-thermal Equipment]

[Abstract] Various means of economizing electrical energy by the use of laser units for work hardening of mechanical engineering parts are described. As an example the advantages of using lasers in treatment of U8A and Kh12M steel punches with a maximum diameter of the lip of 24 mm were investigated. Tests of the experimental batches were conducted on the plant presses of the Novomoskovskbytkhim Production Association. As another example, a process for laser work hardening of the casing for the differential of the rear bridge of the MTZ80 tractor was developed. The possibility is shown of a significant economy of energy expenditures from the use of the process for laser work hardening, principally because of the localization of heating. Figures 2.

6415/9716

CSO: 1860/239

TIME SEARCH FOR PULSE SIGNALS OF SINGLE-ELECTRON PHOTODETECTORS

Kiev IZVESTIYA VYSSHIKH UCHEBNIKH ZAVEDENIY: RADIOELEKTRONIKA in Russian
Vol 28, No 3, Mar 86 (manuscript received 4 Feb 85) pp 100-103

[Article by K.Ye. Romyantsev]

[Abstract] A study is made of the process of searching for pulse signals assuming that the photosensor channel utilizes a single-electron photosensor which allows separate recording of each photoelectron. Detection of the moment of arrival of a light pulse is based on the assumption that the light pulse repetition frequency is known at the receiving end. In the receiving channel, the output process of the photodetector is compared to a threshold level. Operation of the threshold device at a time less than the repetition period shifts the system into a waiting mode, during which time the channel will not react to the single-electron photosensor for a time equal to the repetition period minus an uncertainty interval. The probability of proper detection can be increased to over 90% by proper selection of the uncertainty time and operating threshold. Figures 3, references: 3 Russian.

6508/9716

CSO: 1860/232

UDC 535.317.1

STATISTICAL MODEL DESCRIBING OPTICAL IMAGE OF ASTRONOMICAL OBJECT DISTORTED BY ATMOSPHERE AND SPACE SPECTRUM OF THAT IMAGE

Gorkiy IZVESTIYA VYSSHIKH UCHEBNIKH ZAVEDENIY: RADIOFIZIKA in Russian Vol 29, No 3, Mar 86 (manuscript received 22 May 84 after revision 26 Oct 84) pp 274-280

[Article by P.A. Bakut, A.D. Ryakhin, K.N. Sviridov and N.D. Ustinov]

[Abstract] A statistical model is constructed for describing the optical image of an astronomic object, an image formed by a telescope and distorted by atmospheric turbulence. The diameter of the telescope aperture is assumed to be much larger than the space correlation radius of atmospheric distortions of the optical radiation field, as in most practical cases under normal meteorological conditions. Only phase distortions are appreciable, in the astronomic approximation of an atmospheric screen, their statistical distribution being a normal one with zero mean and a dispersion much larger than 2π so that the distribution becomes approximately uniform within the $-\pi, \pi$ range. If the atmosphere is further assumed to be "frozen", then the optical radiation field produced in the plane of the telescope aperture by a monochromatic point source has a log normal distribution with zero mean. The space spectrum of a distorted image and its statistical model are obtained by Fourier transformation of its intensity distribution. The space spectrum of a real and therefore large astronomic object is more Gaussian than the instantaneous

transfer function of the atmosphere-telescope system, which has important implications for synthesis and analysis of optical objects. Figures 1; references 13: 5 Russian, 8 Western.

2415/9716
CSO: 1860/249

UDC 533.951

EXPLOSIVE BUILDUP OF ELECTROMAGNETIC FIELD AT PLASMA BOUNDARY DURING
INTERACTION OF SURFACE WAVES AND WHISPERING GALLERY MODE

Gorkiy IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOFIZIKA in Russian
Vol 29, No 2, Feb 86 (manuscript received 17 Jul 84) pp 139-144

[Article by V.F. Kovalev, V.V. Pustovalov, and M.A. Savchenko, Moscow
Institute of Radio Engineering, Electronics, and Automation]

[Abstract] Nonlinear interaction of waves with positive energy at a curvilinear sharp plasma boundary is examined, interaction which results in decay such waves. The possibility of explosive buildup of the electromagnetic field at such a boundary is demonstrated in the case of two short-wave surface modes and a long-wave whispering gallery mode, assuming a cylindrical boundary with vacuum inside and a homogeneous plasma with uniform charge concentration outside. Such a cylindrical boundary forms a resonator. Solution of the corresponding wave equations, for two short-wave surface modes with respective frequencies ω_1, ω_2 and a whispering gallery mode with frequency $\omega_1 + \omega_2$, and application of the law of energy conservation yield an explosive buildup of the amplitude of all three waves. This is a consequence of electromagnetic energy flowing from the plasma region across the boundary into the vacuum and the attendant redistribution of energy in space. Numerical estimates for a cylinder 10 mm in diameter, a metal plasma outside, and a laser emitting 1 J - 0.1 ms pulses of ultraviolet radiation as source of surface waves, yield a field explosion time of the order of 10^{-9} s for purely azimuthal surface waves. References 6: 5 Russian, 1 Western.

2415/9716
CSO: 1860/215

UDC 621.396.69.019.3

UNIFIED APPROACH TO ESTIMATION OF AGING RATE FOR EQUIPMENT AND COMPONENTS ON BASIS OF UNIVERSAL THERMODYNAMIC MODEL

Kiev ELEKTRONNOYE MODELIROVANIYE in Russian Vol 8, No 2, Feb 86 (manuscript received after revision 26 Nov 84) pp 52-55

[Article by Igor Valentinovich Kulikov, candidate of technical sciences, senior scientific associate]

[Abstract] The validity of applying the universal thermodynamic model of the aging rate $V = Ae^{-E_a/kT_e + \Delta h/kT}$ to electronic components and equipment is established by analysis of test data pertaining to resistors (MLT, SP3, SP5), capacitors (K53, KM, K52), diodes (D-411, D310), transistors (2T203B), optrons (30T110A), and microcircuit chips (K504NT2B, K140UD8A). This model allows, accordingly, for different aging mechanisms in different temperature ranges and changes of aging mechanism in time. Here E_a is the aging activation energy and Δh is the change in specific heat as a result of phase transformations, $\Delta h = 0$ during testing at temperatures T (absolute) below the critical. The model can serve as tool for estimation of the natural aging rate on the basis of accelerated tests, with use of data on the drift of parameters which determine acceptability or rejectability. An analysis of the aging processes according to this model indicates that long life of equipment will be ensured by components with a high aging activation energy and a low dynamicity, the latter implying a slow drift of critical performance parameters. Tables 1; references 4: 3 Russian, 1 Western (in Russian translation).

2415/9716

CSO: 1860/206

TROUBLE SHOOTING OF CONTINUOUS OBJECTS ON BASIS OF THEIR SOUND-CONDITION MODELS

Kiev ELEKTRONNOYE MODELIROVANIYE in Russian Vol 8, No 2, Feb 86 (manuscript received after revision 3 Dec 84) pp 56-59

[Article by Aleksandr Valentinovich Latyshev, candidate of technical sciences, senior scientific associate, Institute of Modeling Problems in Power Engineering, UkSSR Academy of Sciences, Kiev]

[Abstract] The problem of trouble shooting a faulty continuous object on the basis of its sound-condition model is solved using the same input signal and the faulty-condition output signal. For this the object is assumed to contain distinguishable subsystems which generally may overlap. It is furthermore assumed that only one subsystem can be faulty. Taking into account the extent of trouble shooting and with the discernibility of faults established on the basis of a theorem pertaining to undistinguishable subsystems, the principle of this method is applied to inertialess objects and to dynamic objects with a separable inertialess part. The respective algorithms of fault locating are in each case based on a validating theorem. A specific example demonstrates the practicality of this method. References 6: 5 Russian, 1 Western (in Russian translation).

2415/9716

CSO: 1860/206

HIGH SPEED, WIDE BAND ANALOG INTEGRATED MICROCIRCUITS

Moscow MIKROELEKTRONIKA in Russian Vol 15, No 2, Mar-Apr 86 (manuscript received 23 May 85) pp 109-113

[Article by T.M. Agakhanyan, Moscow, Engineering-Physics Institute]

[Abstract] The increasing need for high-speed and wide band analog devices indicates a need for mass production of universal analog devices, probably based on integrated operational amplifiers. The characteristics required by such devices are noted. The development of these devices must be done in consideration of the requirements placed on integrated analog devices in circuits in which they will be used. The first of these is the requirement for stable operation of the analog devices with feedback without the use of integrating correcting circuits. The second problem results from the formation of powerful voltage and current bursts when steep pulse signals are transmitted or during amplification of the high frequency spectrum of harmonic signals. The most effective means of solving these problems is the use of a high speed channel connected in parallel to the element of the integrated circuit with the greatest inertia and the least steepness of characteristic. The high speed channel has a correcting influence because connection of the channel forms a band some distance from the coordinate origin, the remaining bands are shifted toward the coordinate origin and a null is formed which decreases the phase shift in the high frequency area and thus increases stability. Figure 1, references 9: 7 Russian, 2 Western.

6508/9716

CSO: 1860/244

CALCULATION OF TEMPERATURE FIELDS IN HYBRID INTEGRATED MICROCIRCUITS

Moscow MIKROELEKTRONIKA in Russian Vol 15, No 2, Mar-Apr 86 (manuscript received 19 Jun 85) pp 173-179

[Article by R.R. Babayan, P.I. Retinskiy, V.I. Glushchenko, A.F. Bikulov, A.P. Zhukov and N.V. Morozova, Institute of Control Problems]

[Abstract] The temperature of hybrid integrated circuit structural elements can be calculated using a heat flux equation which is an analog of Ohm's law. A more promising method of calculation is that of mathematical modelling. This article studied hybrid integrated circuits in which conductive heat transfer occurs from one or both large surfaces of the substrate in any combination with the ends. The circuits are assumed to have a rectangular multilayer structure. Experimental studies have demonstrated that the method suggested for calculating the temperature fields in hybrid integrated circuits is more precise than those presently used, having an error of 2 to 3% as opposed to 10% for present methods, but requires large amounts of machine time. Figures 2, references 6: 5 Russian, 1 Western.

6508/9716
CSO: 1860/244

UDC: 539.293:535-36

INFLUENCE OF SMALL DOSES OF GAMMA RADIATION ON STRUCTURE OF MICRODEFECTS AND ELECTROPHYSICAL PROPERTIES OF SILICON SINGLE CRYSTALS AND EPITAXIAL LAYERS

Moscow MIKROELEKTRONIKA in Russian Vol 15, No 1, Jan 86 (manuscript received 23 May 85) pp 36-41

[Article by V.G. Mokerov, S.N. Nikiforova-Denisova, Ye.N. Ovcharenko, V.P. Panosyuk, V.I. Smirnov, Yu.A. Timoshnikov and I.P. Chernov, Scientific Research Institute of Nuclear Physics, Tomsk Polytechnical Institute imeni S.M. Kirov]

[Abstract] A study is made of the effect of gamma quanta on the swirl picture of microdefects in silicon single crystals as well as the electrophysical characteristics of silicon single crystals, epitaxial layers and devices based on them. The study was performed on twenty plates 76 mm in diameter doped with boron with a specific impedance of 10 ohm·cm and orientation $\langle 111 \rangle$, separated into two equal parts by laser scribing. One-half of each plate was bombarded with gamma quanta, dose $5 \cdot 10^4 R$, then both parts were heat treated in a diffusion furnace in moist oxygen at 1200°C for one hour for better visualization. The oxide was removed, then they were subjected to selective etching for 3 minutes. The studies indicated alteration in defect structure as a result of bombardment of low doses of gamma radiation. Depending on the initial state of the material, microdefect density may or may not be preserved. Alteration in defect structure leads to a change in such important parameters

as generation lifetime of current carriers and leakage current of p-n junctions, the direction of change of which varies even within a single plate. Figures 4, references 16: 11 Russian, 5 Western.

6508/9716
CSO: 1860/221

UDC: 621.382.535.21

INFLUENCE OF POWERFUL LASER RADIATION ON CHARACTERISTICS OF THIN SILICON NITRIDE FILMS

Moscow MIKROELEKTRONIKA in Russian Vol 15, No 1, Jan 86 (manuscript received 18 May 84) pp 42-45

[Article by Ya.O. Royzin and Khan Su Khuan, Odessa State University]

[Abstract] A study is made of the effect of accumulation of changes in electric characteristics under the influence of neodymium laser pulses with energy density below the threshold of visible damage. After irradiation, conductivity becomes significantly more heterogeneous. In specimens of Si_3N_4 implanted with boron and phosphorus ions the only effect observed was an additional increase in penetrating conductivity. Laser annealing of radiation defects in the substrate was not observed. The fact of increased heterogeneity of conductivity over the area indicates heterogeneity of absorption. This is possibly due to the presence of inclusions in the matrix of silicon nitride, transparent at the laser wave length. Partial restoration of the initial structure of defects occurs upon annealing. Figures 3, references 9: 7 Russian, 2 Western.

6508/9716
CSO: 1860/221

UDC: 621.382:681.14-32

BUILT-IN HARDWARE FOR SELF-TESTING OF LARGE INTEGRATED CIRCUITS

Moscow MIKROELEKTRONIKA in Russian Vol 15, No 1, Jan 86 (manuscript received 14 Nov 84) pp 70-76

[Article by V.N. Yarmolik, Minsk Institute of Electronic Engineering]

[Abstract] Problems of the synthesis of hardware for self-testing of VLSI integrated circuits to achieve the maximum completeness of testing of these devices are quite important. This article determines necessary and sufficient conditions for a generating polynomial used to formulate a sequence of pseudo-random test signals for this purpose. The sufficient conditions are satisfied by selecting a generating polynomial for which there is no linear dependence between the symbols in the test set. The procedure for selecting the required polynomial is quite complex. The use of the method here described for synthesis of the test sequence generator can reduce the complexity of the synthesis procedure, decreasing the length of the test sequence and the hardware complexity of the generator. Figures 2, references 17: 11 Russian, 6 Western.

6508/9716
CSO: 1860/221

PARASITIC INDUCTION IN HYBRID MICROCIRCUITS

Moscow RADIOTEKHNIKA in Russian No 3, Mar 86 (manuscript received 1 Mar 85)
pp 37-39

[Article by B.A. Putilov]

[Abstract] A simple method of calculating induction interactions in a non-homogenous medium is considered. It is particularly effective during analysis of stray (spurious) couplings which occur in hybrid integrated circuits (HIC) at relatively large intervals. A qualitative analysis and an evaluation of the level of stray couplings in a HIC model are described and a comparison is made of the experimental and calculated data. Figures 2; references: 4 Russian.

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CSO: 1860/243

EFFECT OF DIFFRACTIONAL DIVERGENCE OF ELASTIC WAVES ON CHARACTERISTICS OF
ACOUSTOOPTICAL SPECTRUM ANALYZER

Gorkiy IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOFIZIKA in Russian Vol 29,
No 3, Mar 86 (manuscript received 10 Dec 84) pp 374-376

[Article by V.V. Molotok and B.P. Razzhivin, Leningrad Institute of Aviation
Instruments Design]

[Abstract] An acoustooptical spectrum analyzer with an isotropic light-sound guide in the modulator and a Fourier lens behind the modulator is considered for evaluation of the effect of diffractive divergence of harmonic elastic waves propagating through such a modulator on the linear measurement error, other causes of this error being attenuation of the elastic waves through absorption and frequency constraints on their diffraction of light waves. The analyzer performance is described, in terms of a space integral representing a two-dimensional Fourier transformation, for a plane harmonic light wave obliquely impinging on the modulator and diffracted by the acoustic wave traveling through the latter. Calculations in the approximation of a weak sound and of a light wave in the first diffraction order only indicate that divergence of elastic waves during diffraction causes a weighting of the spectrum of the input signal. This lowers the level to which the amplitude-frequency characteristic may drop from 0.7 to 0.6 and thus allows using in the acoustooptical modulator a piezoceramic transducer plate 3 times thinner than according to the conventional radio engineering criterion. Figures 3; references 6: 5 Russian, 1 Western (in Russian translation).

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CSO: 1860/249

DIFFRACTION OF SURFACE ACOUSTOELECTRIC PULSE BY SHIELD EDGE

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 31, No 1, Jan 86
(manuscript received 20 Aug 84) pp 197-200

[Article by V.V. Popov]

[Abstract] Diffraction of a surface acoustoelectric δ -form shear pulse by the edge of a metal shield on Class C_{6v} piezoelectric plate is analyzed, assuming here that not the entire surface of this plate has been metallized and that the plate has a sixth-order symmetry with respect to an axis normal to its surface. The diffraction field is calculated by the Wiener-Hopf method with approximate factorization, after preliminary Laplace and Fourier transformations of elastic displacement and Coulomb potential in the piezoelectric plate. With no diffraction field existing before the pulse has reached the shield edge, elastic displacements in the volume-scattered field after the pulse has reached the shield edge occur only at distances from that edge smaller than st (s - velocity of volume shear wave, t - time). Figures 1; references: 2 Russian.

2415/9716
CSO: 1860/210

UDC [621.335:625.2.012.858.538.65]:621.313.13-12

VERTICAL OSCILLATIONS OF HIGH-SPEED GROUND-TRANSPORTATION VEHICLE WITH
ELECTRODYNAMIC SUSPENSION ABOVE ROADBED OF FINITE WIDTH

Novocherkassk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ELEKTROMEKHANIKA in
Russian No 1, Jan 86 (manuscript received after revision 11 Feb 85) pp 5-13

[Article by Aleksandr Sergeyevich Rodionov, lecturer, and Vladimir Ivanovich
Astakhov, candidate of physico-mathematical sciences, assistant professor,
Novocherkassk Polytechnic Institute]

[Abstract] Vertical oscillations of an HSGT vehicle with electrodynamic suspension moving at a constant horizontal velocity above a roadbed of finite width are analyzed, these particularly critical principal oscillations being produced by interaction of the traveling magnetic field and eddy currents in the roadbed. They are described by a nonlinear ordinary second-order differential equation. The rigorous formulation takes into account "armature reaction" of the roadbed and its effect not only on the position of the vehicle but also on the vertical component of its velocity. In the more approximate formulation the second effect is disregarded and the levitation force in the dynamic mode is assumed to have the same magnitude as during quiescent motion with the same nominal clearance. In reality the levitation force on the vehicle in the dynamic mode is equal but opposite to the vertical component of the reaction force on the roadbed and, since the magnetic induction in the roadbed is known for a given external magnetic field, only the sheet density of eddy currents in the roadbed must be determined for calculation of these forces. It is found from the corresponding Maxwell field equations, considering that the velocity of the vehicle is much lower than the velocity of light in vacuum, and with the aid of the Biot-Savart law. A solution to the nonlinear differential equation of motion can then be obtained by numerical integration using the Hemming predictor-corrector. The problem was simulated on a YeS-1022 digital computer for a vehicle weighing 40 tons and moving at 400 km/h. Three transient responses were evaluated: 1) to a jump change of the electrical clearance, 2) to a periodic unevenness of the roadbed structure, 3) to a jump change of the electric current in the bearing circuit. The results indicate that the "steady motion" analogy does not adequately describe the dynamics of such a system with a roadbed of finite width, while the rigorous approach reveals a damping of oscillations and an increase of the natural frequency. For this particular vehicle a 10% jump of the bearing current was found to generate a control force equal to 44% of the weight, oscillations not becoming unstable

with the maximum change of mechanical clearance not exceeding 10% but the maximum acceleration exceeding the permissible level up to 0.6g. Figures 4; tables 1; references 6: 4 Russian, 2 Western (in Russian translation).

2415/9716
CSO: 1860/211

UDC [621.335:625.2.012.858:538.65]:621-313.13-12

CALCULATION-EXPERIMENTAL INVESTIGATION OF LIFTING, BRAKING, AND PUSHING FORCES
ON MODELS OF SINGLE-POINT ELECTRODYNAMIC SUSPENSION

Novocherkassk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ELEKTROMEKHANIKA in
Russian No 4, Apr 86 (manuscript received 12 June 84) pp 51-56

[Article by Ludmila Filippovna Boronina, candidate of technical sciences, assistant professor, Leningrad Polytechnical Institute; Sergey Vladimirovich Vasilyev, candidate of technical sciences, senior scientific-research worker, Leningrad Polytechnical Institute; Anatoliy Ivanovich Kiyenko, senior scientific-research worker, Leningrad Polytechnical Institute; Svetlana Stepanovna Proskurenko, candidate of technical sciences, assistant professor, Dalnevostochniy Polytechnical Institute, and Asa Stanislovovna Chernysheva, candidate of technical sciences, Dalnevostochniy Polytechnical Institute]

[Abstract] Experimental investigations were conducted on laboratory models constructed at the Leningrad Polytechnical Institute, differing from those well known, from which the levitation characteristics are obtained of a system of electrodynamic suspension. Experimental data concerned with the lifting, braking, and pushing forces obtained from various models are presented. Figures 4; references: 5 Russian.

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almost linear and field saturation occurs. Amplifier gain and efficiency have been calculated numerically as functions of the modulation level and as functions of the ratio of signal power to beam power, for ratios 0.1, 0.8, 9.9 of beam current to starting current. Calculations were made for the two special cases of velocity modulation only with the klystron modulator at the entrance to the amplifier stage and density modulation only with the klystron modulator at a certain distance farther along the amplification stage as well as for the general case of both modulations. The results reveal that maximum efficiency is attainable with density modulation and with an open resonator in the output stage, this maximum attainable efficiency being determined by the beam accelerating voltage. Velocity modulation causes the optimum bunching to depend on the parameters of the output resonator. Figures 3; references: 8 Russian.

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CSO: 1860/215

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IMPROVING SENSITIVITY OF BWA SCANNING SUBMILLIMETRIC-WAVE SPECTROMETER BY MEANS OF QUASI-OPTICAL RESONANCE

Gorkiy IZVESTIYA VYSSEJAJI UCHEBNOJ GOVARDENOSTI: MANUSCRIPT IN Russian
Vol 29, No 2, Feb 86 (manuscript received 25 Apr 85) pp 240-244

[Article by V.P. Karakov, V.V. Korobko, and A.M. Dzyubina, Institute of Applied Physics, USSR Academy of Sciences]

[Abstract] Use of a quasi-optical resonator for improving the sensitivity of a BWA (backward-wave amplifier) scanning submillimetric-wave spectrometer is evaluated on the basis of experimental data and theoretical considerations. Experiments were performed with a backward-wave tube oscillator as the radiation source, a hemispherical horn waveguide leading to the resonator cavity with an acoustic detector, and an optical stage for alignment of the resonator axis relative to the horn of the oscillator and as well as for adjustment of the standing-wave ratio in the waveguide. A diode with lowpass filters suppressed acoustic noise in the absorption cell. Tests were performed at weak lines of an H_2O molecule in vibrationally excited states 0_{01} , 1_{00} , 0_{40} , 0_{30} and at the line of PH_3 impurity in CO_2 over the 100-400 cm frequency range. In the scanning mode at resonance with the 0_{40} line ($\lambda = 1.4 \times 10^{-3}$ transition) were also detected weak lines of vibrationally excited states $00^{\circ}1$ and $20^{\circ}0$, not previously detected by scanning the rotationally excited spectrum. Although the resonator method precludes detection of weak lines along the tails of intense transitions, detuning from resonance will extend the high sensitivity over a wide range of the spectrum. A sensitivity of $3 \cdot 10^{-14}$ cm^{-1} within a time period of the order of 1 s should be attainable with a tunable rather than fixed quasi-optical resonator. A disadvantage of this method is the need to lock the resonator frequency to the oscillator frequency, which makes it difficult to find weak lines of not exactly known frequency. The authors thank A.F. Krupnov for formulating the problem and discussing the results. Figures 3; tables 1; references 11-6 Russian, 1 English.

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CONSTRUCTION OF THE UNIFORM MICROWAVE STRUCTURES OF HIGH-SPEED COMPUTERS

Moscow RADIOTEKHNIKA in Russian No 3, Mar 86 (manuscript received 17 July 85)
pp 3-9

[Article by O.D. Barantseva]

[Abstract] A detailed description is given of the distinctive constructive features used in modeling circuits of the cells of a microwave uniform computational structure (UCS) with microwave devices having electric hysteresis, as well as elements and functional microwave units among the cells of a microwave UCS for a high-speed digital computer. It is concluded that the cells of a microwave computer structure utilizing microwave industrial devices with electric hysteresis (or negatrons) make it possible to accomplish modeling of various units of an electric digital computer with control of the video- or radio-frequency pulses and with a combination of their action. High-speed cells of a microwave UCS are reliable in operation even when exposed to large gradients of temperature and radiation. It is possible to fulfill them constructively in the form of an UCS and to arrange without crossings the interconnections in the two layers of the matrix (or with two sides of the UCS board). Figures 6; references 7: 6 Russian, 1 Western.

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CSO: 1860/243

UDC 621.317.335.3

EXPRESS METHOD OF MEASURING RELATIVE DIELECTRIC CONSTANT

Moscow RADIOTEKHNIKA in Russian No 3, Mar 86 (manuscript received 8 July 85)
p 94

[Article by V.I. Afromeyev and Yu.A. Pokrovskiy]

[Abstract] A method is proposed for measuring the relative dielectric constant (ϵ) based on a measurement of the critical length of a waveguide filled by the dielectric under investigation. An experimental check of the proposed method was conducted on dielectrics of the following types: Quartz, ST-10, Fluoroplastic-4 [Soviet equivalent of teflon], and Polystyrene. An analysis of the results of measuring ϵ as compared with data obtained on standard units made it possible to conclude that the relative error of measurement of ϵ is not more than $\pm 2\%$. The proposed method is simple and is convenient for checking ϵ with commercially produced dielectrics and products made from them. Figures 1; references: 2 Russian.

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CSO: 1860/243

POWER GYROTRON FOR THIRD HARMONIC OF A CYCLOTRON FREQUENCY

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 31, No 2, Feb 86 (manuscript received 29 Mar 84) pp 334-336

[Article by S.A. Malygin]

[Abstract] The possibility in principle of effective operation of cyclotron resonance lasers, in particular gyrotrons (firm name for vibrating gyroscope), for the harmonics of cyclotron frequency is known. However, in proportion to an increase of the number of harmonics, realization of power devices becomes increasingly more difficult. In connection with this fact experimental investigations were made of a gyrotron operating at the third harmonic of cyclotron frequency. The experiments bore witness to the effective selection of vibrations in gyrotrons containing a system of combined resonators with mode transformations, making it possible to realize stability of single-mode vibrations at the third harmonic of the gyro frequency. Suppression of the parasitic vibrations in the relatively high-Q output resonator is connected with preliminary energy modulation of the electron beam by an operating type field in the input resonator. At the same time excitation of the interfering modes in the input resonator is practically excluded because of its small length and Q-factor. Optimization of the electron-optical and electrodynamic systems would assist an increase of the efficiency. The pulse output power of the generator reached 150 kW at a 5.6-mm wavelength with an efficiency of $\sim 100\%$. The author thanks Sh.Ye. Isimring and V.Ye. Zapevalov for attention to the work and for assistance. Figures 4; references 9: 8 Russian, 1 Western.

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SIMILARITY LAWS FOR RELATIVISTIC AND NONRELATIVISTIC O-TYPE ELECTRON-WAVE SYSTEMS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 31, No 2, Feb 86 (manuscript received 20 Dec 84) pp 413-416

[Article by N.L. Romashin and V.A. Solntsev]

[Abstract] The article is concerned with the construction of similarity laws for O-Type electron-wave systems, with the aid of which it is possible with a controlled error directly to employ an experiment for creation and investigation of nonrelativistic systems for their relativistic analogs. A relativistic dimensionless nonlinear system of equations for O-Type electron-wave systems is obtained. Figures 2; references: 6 Russian.

6415/9716
CSO: 1860/241

UDC 621.316.56.3.064.43

PROCESS OF GAP FORMATION BETWEEN CONTACT SURFACES IN EXPLOSION-TYPE CIRCUIT BREAKERS

Novocherkassk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ELEKTROMEKHANIKA in Russian No 1, Jan 86 (manuscript received after revision, 29 Jan 85) pp 81-87

[Article by Valeriy Leonidovich Korolkov, candidate of technical sciences, senior scientific associate, Aleksandr Yefimovich Nesterenko, graduate student, and Aleksandr Anatolyevich Sivkov, candidate of technical sciences, senior scientific associate, Scientific Research Institute of High Voltages, Tomsk Polytechnic Institute]

[Abstract] The process of gap formation between contacts in a circuit breaker with an explosion mechanism is analyzed on the basis of energy relations in such a device, which essentially consists of two stationary current-carrying electrodes bridged by a tubular fuse inside a tightly sealed hollow cylinder made of an insulating material. The fuse is a thick-walled tube with an explosive charge at the center and an arc-quenching substance, usually transformer oil, filling the space inside. Grooves cut lengthwise around its outside surface reduce the amount of energy necessary for blowing it up. An air cushion along the inside surface of the cylindrical enclosure allows for movement after the explosion. Motion of the fuse under pressure of the shock wave following the explosion produces the gap, in three stages. First the fuse expands till it ruptures along the grooves, then its fragments continue moving until the entire air cushion has been replaced with the arc-quenching transformer oil, whereupon they move through that oil. The energy relations during gap formation by this mechanism are established with the aid of experimental data supplementing the general laws, taking into account the explosion dynamics with shock wave propagation and reflection as well as the arc-quenching kinetics in the given configuration. A semiempirical expression is thus obtained for the pressure on the fuse

$$P = 10^7 (0.018 - 0.031 s_0 / s_T) \dot{r} e^{0.0026 t (s_0 / s_T) - 0.075} \quad (s_0 - \text{lateral surface area of fuse prior to rupture, } s_T - \text{area of gaps between its parts after rupture, } r - \text{outside radius of fuse prior to rupture, } \dot{r} - \text{velocity of fuse parts after rupture. Figures 3; tables 1; references: 6 Russian.}$$

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CSO: 1860/211

MAXIMUM VELOCITY OF FERROMAGNETIC ARMATURE IN ONE-SHOT ELECTROMECHANICAL ENERGY CONVERSION

Novocherkassk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ELEKTROMEKHANIKA in Russian No 1, Jan 86 (manuscript received 11 Nov 84) pp 91-94

[Article by Viktor Vasilyevich Ivashin, doctor of technical sciences, professor, and Igor Aleksandrovich Miloradov, candidate of technical sciences, assistant professor, Togliatti Polytechnic Institute]

[Abstract] The acceleration of a ferromagnetic armature during one-shot operation of an electromechanical energy converter is analyzed from the standpoint of performance and design. The general energy-force-displacement relations applicable to all such devices, where motion of the armature causes the gap volume to decrease and the gap permeance to increase, are formulated for the specific simple case of a bar armature moving transversely through the magnetic field between two poles of a shell-type inductor. Calculations confirm that the work done by such a converter with a given magnetic induction within the interaction space cannot exceed the energy of a magnetic field with the same induction within a volume of nonmagnetic medium equal to the volume of the armature. While the ratio of produced mechanical energy to armature weight reaches its maximum as the relative width of the armature approaches zero, maximum mechanical energy is produced with an armature half as wide as the gap. Letting the magnetic induction in the gap be the maximum possible, corresponding to the saturation induction B_s in the armature iron, the maximum velocity to which an armature with a relative width $b = 0.5$ can be accelerated is $v = 10B_s$ or 15-20 m/s ($B_s = 1.5-2$ T). Higher velocities require multistage acceleration, velocities attainable by motion across a magnetic field being generally higher than those attainable by motion parallel to the magnetic field. Figures 2.

2415/9716

CSO: 1860/211

UDC 621.313.13

INVESTIGATION OF DAMPING PROPERTIES OF ELECTRIC DRIVE OF ICE-BREAKER PROPELLER

Novocherkassk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ELEKTROMEKHANIKA in Russian No 4, Apr 86 (manuscript received 9 Oct 85) pp 107-110

[Article by Sergey Vladimirovich Bykov, candidate of technical sciences, senior scientific-research worker, Leningrad Higher Engineering Maritime School imeni Admiral S.O. Makarov]

[Abstract] A theoretical analysis, mathematical modeling, and experimental investigations demonstrate the possibility of a significant increase of the damping properties of the electric drive of an ice-breaker propeller which leads to a decrease of the dynamic loads on all the elements of the propulsive complex and an increase of their service life. The proposed regulators,

which increase the damping properties of the electric drive, have been introduced on powerful arctic ice-breakers. Figures 2; references: 4 Russian.

6415/9716
CSO: 1860/260

UDC 621.316.542.027.3-186.2:537.51

INVESTIGATION OF DIELECTRIC STRENGTH OF HIGH-VOLTAGE VACUUM ARC BLOWOUT CHAMBERS AFTER CURRENTLESS COMMUTATION

Moscow ELEKTROTEKHNIKA in Russian No 3, Mar 86 (manuscript received 22 Jan 85) pp 38-40

[Article by Ye.A. Shokhin, engineer, and M.Ye. Danilov, candidate of technical sciences, All-Union Electrotechnical Institute imeni V.I. Lenin]

[Abstract] The dielectric strength was investigated of the intercontact interval of the contact system of a vacuum arc blowout chamber (ABC) at 35 kV, after currentless commutation with increased voltage. The investigations were conducted on a knock-down model of a high-voltage ABC which consisted of a metal vacuum-type tank, a high-voltage lead-in at 300 kV, and a system of electrostatic shields. The metal tank has two optical openings which make it possible simultaneously to conduct optical as well as electrical investigations. The complex dependence is shown of the breakdown voltage of the ABC after currentless commutations as a function of the speed of encounter of the contacts and the distance between them. Figures 4; references 12: 5 Russian, 7 Western (1 in Russian translation).

6415/9716
CSO: 1860/239

UDC 669.187.012

UTILIZATION OF SECONDARY ENERGY SEPARATION IN FERROALLOY ELECTRIC FURNACES

Moscow ELEKTROTEKHNIKA in Russian No 3, Mar 86 (manuscript received 27 May 85) pp 20-23

[Article by V.L. Rozenberg, candidate of technical sciences, L.A. Ryazantsev, engineer, A.G. Lykov, A.S. Polyakov, and A.G. Lunin, candidates of technical sciences]

[Abstract] Ferroalloy electric furnaces (FEF) are the most common type of ore-smelting furnaces in use at ferrous metallurgy enterprises for production of ferroalloys and silicon. Investigations of the operating conditions of such furnaces with a power of 16.5-63.0 megavolt-amperes demonstrated that they are a powerful source of secondary thermal energy, the use of which makes it possible to decrease the overall energy expenditures and to reduce the effect of the operation of furnaces on the environment. Data from the literature are analyzed and the prospects for utilization of the secondary energy

are discussed. A number of methods for its utilization, both in the technological process itself and outside the furnace for the energy requirements of other users, are presented. References 24: 20 Russian, 4 Western.

6415/9716
CSO: 1860/239

UDC: 551.46.01

TRANSFORMATION AND UTILIZATION OF HEAT ENERGY RESOURCES OF THE OCEAN

Minsk IZVESTIYA VYSSHIKH UCHEBNIKH ZAVEDENIY: ENERGETIKA in Russian No 2, Feb 86 pp 3-9

[Article by A.K. Ilyin, candidate of technical sciences, assistant professor, Pacific Institute of Oceanography]

[Abstract] The power of heat energy resources available in the temperature difference between surface and deep water in the tropical regions of the ocean is not over 11 billion kw, 0.016% of the power received by the earth in solar energy. The more realistic energy potential considering heat losses of probable designs is 6 to 7 billion kw, which is comparable to the total world consumption of electric power at the present time. It is more difficult to estimate the potential of Arctic heat energy power plants. The available power tropical plants can be increased by additionally utilizing solar energy to heat the surface water above its natural temperature, thus increasing the heat difference between surface and deep water available for power generation. American plans for tropical power plants are mentioned. The significance of ocean power plants is increased if they are looked upon not as simple power plants but also as plants producing large quantities of liquid and gaseous hydrogen and ammonia as well as fresh water. Figures 4, references 7: 5 Russian, 2 Western.

6508/9716
CSO: 1860/225

UDC: 621.311.16:658.155.015.2

ESTIMATE OF LOSS FROM VARIATIONS OF VOLTAGE IN COMMERCIAL POWER NETWORKS

Moscow PROMYSHLENNAYA ENERGETIKA in Russian Vol 15, No 1, Jan 86 pp 16-17

[Article by V.A. Otsepkov, engineer, Sibenergotsvetmet Production Association]

[Abstract] An equation is presented for calculation of the costs resulting from variations of the voltage in commercial lighting networks from the nominal voltage, including the cost of replacement of lightbulbs. Calculations indicate that the loss due to overvoltages is largely compensated by savings achieved with undervoltages. Figure 1, references: 4 Russian.

6508/9716
CSO: 1860/218

INCREASING THE EFFECTIVENESS OF UTILIZATION OF ENERGY RESOURCES AT LIGHT INDUSTRY ENTERPRISES

Moscow PROMYSHLENNAYA ENERGETIKA in Russian No 1, Jan 86 pp 6-7

[Article by E.A. Ezekyan, engineer, USSR Light Industry Ministry]

[Abstract] During the 11th Five-Year Plan, some 992 obsolete boilers were replaced, 194 small and uneconomical boilers were shut down with consumers switched to centralized heat supplies and 120 boiler shops were switched to gas. Electric power networks were redesigned at 368 enterprises. Some 13,800 electric meters were installed. Each year, as many as 100 enterprises take part in the All-Union competition for best energy savings suggestions. Organizational and technical measures of this sort have achieved a savings of some 500,000 tons of fuel, 2.5 million Gcal of heat and 950 million kw·hr of electric power during the 5-year plan. However, there is still a tendency toward increased power consumption per unit of output in light industry.

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UDC: 621.311.1.004.18

RESULTS OF FORTIETH ALL-UNION COMPETITION FOR BEST SUGGESTIONS FOR SAVING ELECTRICAL AND HEAT ENERGY

Moscow PROMYSHLENNAYA ENERGETIKA in Russian Vol 15, No 1, Jan 86 pp 8-10

[Article by V.P. Nuzhin, chairman, All-Union Competition Jury, and I.M. Fetisova, Executive Secretary, All-Union Competition Jury]

[Abstract] The Fortieth All-Union Competition called forth 1,651 suggestions with a total economic effect of 2.3 million kw·hr electric power, 2.7 million Gcal heat energy. Workers in the metallurgy, chemistry, petrochemistry and oil refining, motor vehicles, light and textile industries were most active. The jury awarded prizes to the 205 best suggestions. First prize went to workers at Nizhnekamskneftekhim Production Association, Lenneftekhim Scientific Production Association and the Voronezh Branch of Giprokauchuk for a suggestion entitled "Development and introduction of energy savings technology for production of isoprene in the production of synthetic rubber using KBF-76 catalyst." The suggestion has yielded an annual savings of 141,700 Gcal of heat energy. Other award winning suggestions included "Improvement of the design of KTJ-12.5/35 centrifugal compressor," suggestions for improvement of technological processes for working of motor vehicle parts, "Study and introduction of operating conditions of PT-60-130/13 turbines with nominal steam consumption in the high pressure section and minimum ventilation throughput of steam in middle and low pressure sections with middle pressure section valves completely closed," and a suggested change in the technological process of producing blister copper. The Forty-First All-Union Competition for best suggestion for savings of energy will be held in 1986.

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ACCELERATE PROGRESS

Moscow ELEKTROTEKHNIKA in Russian No 1, Jan 86 pp 3-7

[Article by G.P. Voronovskiy, Minister of Electrotechnical Industry]

[Abstract] Following its achievements and contributions to the national economy in the 11th Five-Year Plan, the electrotechnical industry will have to overcome many deficiencies in planning and management in order to meet its goals in the 12th Five-Year Plan. This will require better organization and discipline, more responsibility and more creative initiative at all levels. High priority has been assigned to boosting the manufacture of electrical machinery, a 39.1% increase of the production volume with a 46.2% higher productivity and an 11.3% lower unit manufacturing cost. This machinery will include a standard series of 63-800 MW turbogenerators as well as 1000 MW turbogenerators for atomic electric power plants. Other priority items are more reliable control of nuclear power, more efficient and economical distribution of electric energy over 1150 kV a.c. and 1500 kV d.c. transmission lines, updating mechanization and automation of industrial processes, including introduction of robotized flexible production systems, supplying more and better electrical equipment to the major industrial customers such as the metallurgical industry with a great need for electric-arc furnaces, the railroad transportation industry, the machine tool manufacturing industry, the agricultural industry, and many others like electroplating plants and electric welding plants. Special-purpose technological equipment is to be produced at a 228% faster rate than in the 11th Five-Year Plan. The economic impact of the 12th Five-Year Plan and the next two is to equal that of all the preceding ones since the Soviet Union was established. This will require better collaboration of the scientific community, best achieved by expanding the scientific-industrial associations, and recognition of this industry's role in meeting the objectives of the CPSU. One objective is to double the national income and the overall industrial output so as to also double the amount of available consumer goods during the 12th Five-Year Plan period.

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PLANNED ELECTRICAL EQUIPMENT FOR ELECTRIC POWER PLANTS

Moscow ELEKTROTEKHNIKA in Russian No 1, Jan 86 (manuscript received 27 Jun 85) pp 7-9

[Article by I.A. Glebov, academician, USSR Academy of Sciences]

[Abstract] Progress made so far in generator construction is evidenced by the many different machines already built and in operation, ranging from the 1200 MW - 3000 rpm turbogenerator in the Kostrom atomic electric power plant

to the totally enclosed 30 MW - 62.5 rpm hydroelectric generators in several hydroelectric power plants. In order to make further progress in the next 10-15 years, it will be necessary to solve a number of technical problems. Turbogenerators to be built in the next 10-15 years will have to be more reliable. This, according to international practice, is achieved principally by lowering and stabilizing temperature rises and vibration levels. The rule is that at least two prototypes of a new design must be shown to be approximately as reliable as the existing standard series. An analysis of the state of the art in the USSR indicates that here reduction of wear and tear is the principal factor, facilitating repairs and streamlining the overhaul procedure being an important design consideration. Application of microprocessor and computer technology to trouble shooting will also play a significant role in reliability assurance. The power rating of turbogenerators for thermal electric and atomic electric power plants should be extended to 1500 MW, this being achievable by utilization of technology but with better materials: low-loss nonoriented electrical steel and electrical insulation with 5 kV/mm strength. Other design features should include hollow copper conductors, use of new highly effective materials for vibration damping, use of nonmagnetic corrosion-resistant alloys for reinforcement of rotating parts, and use of full liquid cooling. Hydroelectric generators built in the next 10-15 years will include those with higher power ratings within the 500-1000 MW range and those with lower power ratings for plants on small rivers. Hydroelectric generators for installation in Siberia will be generally low-speed machines, just as those installed now, but their voltage ratings should be increased up to 20 kV so as to allow a more efficacious design of such inherently large-size machines. Under consideration are also medium-power (300-400 MW) medium speed (300-500 rpm) generator-motor units for pumped-storage hydroelectric power plants. References: 5 Russian.

2415/9716

CSO: 1860/211

UDC 621.315.05.004.15

TECHNICAL AND ECONOMIC BASIS FOR SELECTION OF VOLTAGE CLASS ABOVE 1150 kV FOR FUTURE A.C. ELECTRICAL TRANSMISSION LINES

Moscow ELEKTROTEKHNIKA in Russian No 1, Jan 86 (manuscript received 8 Aug 85) pp 33-36

[Article by G.A. Apostolatov, candidate of technical sciences, and N.N. Sokolov, engineer, All-Union Institute of Electrical Engineering (Imeni V.I. Lenin)]

[Abstract] While the 1150 kV voltage class was adopted in the 11th Five-Year Plan for construction of new overhead a.c. electric transmission lines, this voltage level being 1.5 times higher than that of the preceding 750 kV class, technical and economic evaluation of the next higher voltage class was begun for adoption in the 12th Five-Year Plan. Theoretical calculations leading to optimum selection of the voltage class within the 1200-2500 kV range are based on the trinomial equation for equipment cost K (rubles/m) = $a_1 + a_2 V^n + a_3 S^m$ (V - voltage (kV), S - conductor cross-section area (mm^2), a_1, a_2, a_3, m, n - design

parameters). Calculations were made for $n = \text{var} = 10-20$ and $n = \text{const} = 24$ split conductors/phase. Equipment was to include autotransformers, distributors, reactors, compensators, protective relaying, KREI circuit breakers, and substation auxiliaries. The technical criterion was maximum efficiency and the economic criterion was minimum cost/(kW·h). Although ideally the voltage level should be doubled, 1800 kV was found to be the optimum next higher voltage class for the coming 10-15 years. Nominal 1800 kV allows 1900 kV, approximately 5% higher, maximum operating voltage. This choice was based on limiting internal overvoltages to 140% and overvoltages caused by lightning surges to 160%, also use of thyristor-type static compensators and gas-filled circuit breakers. This choice of voltage class does not preclude the possibility that a higher voltage level within the 2200-2500 kV may eventually be found to be preferable. Figures 6; tables 4; references: 2 Russian.

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UIC 621.315.21.001.1

OUTLOOK FOR DEVELOPMENT OF POWER CABLE PRODUCTION

Moscow ELEKTROTEKHNIKA in Russian No 1, Jan 86 (manuscript received 30 May 85) pp 43-47

[Article by Yu.V. Obratsov, candidate of technical sciences, and I.B. Peshkov, doctor of technical sciences, professor, All-Union Scientific Research Institute of the Cable Industry]

[Abstract] Power cable production within the USSR Power Development Program for the 1985-2000 period will cover conventional oil-filled cables upgraded for 110-500 kV voltages and new cables with thermoplastic insulation, special underwater cables for off-shore oil drilling, and special cables for atomic electric power plants, also better than existing power distribution cables in the 1 kV voltage class. The attainment of these objectives will depend largely on theoretical and experimental studies made at the All-Union Scientific Research Institute of the Cable Industry. Considering that temperature characteristics and aging of the insulation are the basic factors determining cable design and performance, a model of a two-layer graded insulation system and thermal decomposition as principal aging mechanism has been developed for 110-220 kV oil-filled cables operating in electric fields of up to 15 MV/m intensity with adequate overload capacity. Cables of this type with not more than 7-15 mm thick insulation have already been built and tested for urban power distribution networks with negligible exposure to lightning strokes. Thermoplastic insulation, specifically cross-linked (vulcanized) polyethylene, is preferable to oil not only because of higher allowable operating temperature and lower allowable ambient temperature, also lower dielectric loss tangent, but also because of its much lower cost: typically 106.4 rubles/(MVA·km) of thermoplastic-insulated cable as compared with 365 rubles/(MVA·km) of oil-filled cable. A model based on treeing as principal aging mechanism has been developed for thermoplastic-insulated cables with not only the intensity but also the frequency of the electric field determining the insulation life.

Underwater cables with such an insulation rated for 35 kV have already been built and tested. Cables for atomic electric power plants require not only nonflammable and slow-burning insulation but also radiation-resistant and corrosion-resistant cladding for normal operating temperatures up to 150°C and immune to "standard fire" with 750°C for 1.5 h. Such cables have been built and are now tested according to the most stringent IEC specification No 332-3-1982 category A. They contain impregnated paper with an oxygen index of 22-26 (percentage of oxygen in oxygen-nitrogen mixture which sustains combustion) as insulation. Their cladding is made of aluminum sheet with one layer of refractory bituminous compound + one layer of dacron tape + one layer of unimpregnated fiberglass. These cables are enveloped by protective armor of galvanized steel. Figures 6; tables 1; references: 2 Russian.

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UDC 621.7.004.18

MEANS OF SAVING FUEL-ENERGY RESOURCES AT A MACHINE BUILDING PLANT

Moscow PROMYSHLENNAYA ENERGETIKA in Russian No 3, Mar 86 pp 2-3

[Article by P.Sh. Kapachunskiy, V.B. Nizimov and Ye.D. Khmel'nitskiy, candidates of technical sciences, Dneprodzerzhinsk Industrial Institute imeni M.I. Arsenichev]

[Abstract] An analysis was made of the consumption of fuel-energy resources at the Dnepropetrovsk Metallurgical Equipment Plant. Norms for the expenditure of electrical energy and fuel in the plant's principal production are presented. The principal organization-technical measures with respect to a reduction of specific norms for consumption of fuel-energy resources at the plant include: 1) A rational organization for maintenance of induction furnaces at night and on holidays (because even when idle an electric furnace consumes approximately 150 kW hours of energy); 2) Introduction of progressive technology for drying forms of carbonic acid gas; 3) Regulation of the operating conditions of ventilators and exhaust fans and the equipment of their electric motors with two stages of the rotation frequency; 4) Introduction of the VMG-5000 multioperator welding unit; and 5) Use of controlled excitation of synchronous drives with thyristor converters which increases the power factor of the electric power supply at an enterprise.

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4MT(K)F112 AND 4MT(K)FL32 CRANE MOTORS

Moscow PROMYSHLENNAYA ENERGETIKA in Russian No 3, Mar 86 pp 46-47

[Unsigned article]

[Abstract] 4MT(K)F112 and 4MT(K)FL32 (Class F insulation) crane motors are intended for the drive of cranes and other general purpose mechanisms, the operation of which is characterized by short-time and repeated short-time regimes, as well as large ratios of overloading. 4MT(K)H112 and 4MT(K)H132 (Class H insulation) motors are intended for metallurgical production drives as well as other drives operating in increased temperature of the environment. The motors are designed to operate from 3-phase alternating current networks at 220/380 volts with a 50 Hz frequency. (For customer requirements motors are manufactured which use other standard voltages up to 660 V at 50 and 60 Hz frequencies.) A number of other motors are also considered. Technical data for motors with Class F and H insulation heat resistance are presented in a table. The manufacturer of the 4MT(K)112 motor is the Bavlenskiy Electromechanical Plant, Vladimir Oblast, and that of the 4MT(K)132 is the Electrical Motor Plant, Tbilisi.

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TYPE VP-701 LIMIT SWITCHES

Moscow PROMYSHLENNAYA ENERGETIKA in Russian No 3, Mar 86 pp 47-48

[Unsigned article]

[Abstract] The article describes Type VP-701 limit explosion-protected oil filled switches intended for switching of electric control and signalling circuits of alternating current in the drive of periodically operating mechanisms with an automatic or semiautomatic cycle. The switches are used in stationary installations. In the conventional designation VP-701/1 Exd11T6X2 [Exd is in the Latin alphabet] VP = Limit switch; 701 = number of series; /1 = arrangement indicator as viewed from the reductor (with an arrangement indicator as viewed from the opposite reductor, the digit is absent); 1 = explosion-safety of electrical equipment; Ex = correspondence to explosion-protection standard; d = oil filling of casing; 11 = group of electrical equipment; T6 = temperature class; X2 = climatological use (Y, T) and class of location (2) with respect to GOST 15150-69 and GOST 15543-70. The manufacturer of the switch is the Electrical Equipment Plant in Zelenokumsk.

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CSO: 1860/240

UDC 681.2:537.7

DIFFRACTION OF LIGHT AT RECTANGULAR APERTURE WITH STATISTICALLY UNEVEN EDGE

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST in Russian No 12, Dec 85
(manuscript received 18 Feb 85) pp 10-12

[Article by S.P. Sakhno and G.S. Tymchik]

[Abstract] Using a Fourier optical approximation, the paper studies the diffraction of coherent radiation at a rectangular aperture with a statistically uneven edge. The results of the investigation can be used during analysis of equipment functions of coherent optical spectrum analyzers and Schlieren [shadowgraph] devices (Foucault knife type), as well as during the development of devices intended for checking the state of a cutting tool and the quality of metal working of units under conditions of flexible automated production. Figures 2; references 10: 9 Russian, 1 Western.

6415/9716

CSO: 1860/166

UDC 681.785.5

DISPERSING SYSTEMS WITH CONSTANT MERIDIAN INCREASE IN BOUNDARIES OF LARGE ANGULAR FIELD

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST in Russian No 12, Dec 85
(manuscript received 15 Jul 85) pp 13-14

[Article by V.V. Afanasyev, N.I. Glebkova and V.B. Shlishevskiy]

[Abstract] New dispersing systems are analyzed in which the meridian increase in the limits of a large angular field remains practically constant in a sufficiently wide spectral range. Retention of the constant increase is assured by a mechanism for matching the angles of rotation of a reflecting diffraction grating and an autocollimated mirror in an installation with two-fold diffraction. Some partial versions of the systems considered exist in a 1984 paper by Yu. V. Markin, but the principles and characteristics of their composition were unclear. Figures 3; references 13: 12 Russian, 1 Western.

6415/9716

CSO: 1860/166

CALCULATION OF ENERGY CONCENTRATION IN POLYCHROMATIC IMAGE OF AN OBJECT WITH FINITE DIMENSIONS, PRODUCED BY DIFFRACTION-BOUNDED OPTICAL SYSTEM

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST in Russian No 12, Dec 85
(manuscript received 21 Dec 84) pp 15-17

[Article by I.V. Peysakhson and T.A. Cherenko]

[Abstract] A program for the BESM-6 computer is created for use in a study of the distribution of illumination intensity and the energy concentration in the image of an object produced by a nonaberrational optical system operating in a wide spectral region. The numerical integration in expressions for the polychromatic optical transfer function (OTF) and the energy concentration function (ECF) is accomplished by the Simpson method. Graphs are shown of the ECF: 1) Obtained during a calculation in monochromatic light and with a triangular distribution of the actinic flux; 2) With linearly increasing distribution of the actinic flux; and 3) Obtained during calculation in the spectral region $\lambda_0 \pm 0.5 \lambda_0$ with various distributions of the actinic flux. Figures 3; tables 2; references 3: 1 Russian, 2 Western in translation.

6415/9716

CSO: 1860/166

UDC 535.813.002.2

PRODUCTION OF OPTICAL ELEMENTS FROM POROUS GLASS

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST in Russian No 12, Dec 85
(manuscript received 8 May 85) pp 22-24

[Article by I.K. Meshkovskiy, S.S. Solovyev and V.Ye. Stepanov]

[Abstract] The paper studies the processes involved in production-process annealing of material as well as the essentials of the technology for manufacturing optical parts of porous glass, a characteristic of which is the use of two-stage thermal treatment of material, with the object of stabilizing the structure, properties, and cleansing of porous materials of organic compounds. Figures 2; references 6: 5 Russian, 1 Western.

6415/9716

CSO: 1860/166

APERTURE SYNTHESIS OF ASTRONOMICAL TELESCOPES

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST in Russian No 12, Dec 85
(manuscript received 17 June 85) pp 32-38

[Article by N.A. Dimov]

[Abstract] The paper is concerned with aperture synthesis development in connection with the creation of astronomical telescopes which combine a large light-collection area with high resolution. The following items are considered: 1) The two main approaches at present to the problem of aperture synthesis of astronomical telescopes; 2) Telescopes with compound principal mirror; 3) Synthesis of partly filled aperture; and 4) Alignment and phasing of optical systems of aperture synthesis. The limitations connected with atmospheric turbulences are noted and possible means are considered for decreasing their effect with the use of certain systems of aperture synthesis. Figures 13; references 41: 10 Russian, 6 Western in translation; and 25 Western.

6415/9716
CSO: 1860/166

UDC 621.338

CONSIDERATION OF EFFECT OF STORED CHARGE IN SEMICONDUCTOR LASER DURING FORMATION OF CLOSELY ARRANGED PULSES OF STIMULATED RADIATION

Leningrad IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: PRIBOROSTROYENIYE in Russian Vol 29, No 4, Apr 86 (manuscript received 9 May 84) pp 82-84

[Article by K.N. Kerostik, Belorussian State University imeni V.I. Lenin]

[Abstract] GaAlAs lasers on a double heterostructure with strip-line geometry of the ohmic contact were investigated. The lasers were excited by means of a generator of twin pulses of current, making it possible to regulate the interval between pulses and the amplitude of each pulse separately. The possible effects are considered of the stored charge during formation of a sequence of light pulses with prescribed parameters by varying the parameters of the pulses of the exciting current. The article is recommended by the Department of Quantum Radio Physics and Optoelectronics. Figures 1; references: 2 Russian.

6415/9716
CSO: 1860/263

MONOCHROMATIC OPTICAL SYSTEMS WITH HIGH RESOLUTION

Leningrad IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: PRIBOROSTROYENIYE in Russian Vol 29, No 4, Apr 86 (manuscript received 10 Jan 85) pp 85-88

[Article by G.L. Nikiforova, Leningrad Institute of Precision Mechanics and Optics]

[Abstract] Various methods of designing monochromatic optical systems are considered. In connection with the use of lasers in various areas of science and technology, e.g., for optical recording and readout of information, a modular principle is proposed for the design of objectives with a diffraction image quality. The principal optical scheme of a high-resolution monochromatic objective for a laser pickup with a numerical aperture $\Lambda = 0.45$, focal distance $f' = 4.3$ mm, linear field $2y = 0.1$ mm, effective wave length of laser $\lambda = 0.78$ micrometer is presented, as well as the results of calculations. The article is recommended by the Department of the Theory of Optical Instruments. Figures 1; references: 4 Russian.

6415/9716

CSO: 1860/263

UDC 621.384.3

EVALUATION OF THRESHOLD DIFFERENCE OF TEMPERATURE OF INFRA-RED IMAGING DEVICES

Leningrad IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: PRIBOROSTROYENIYE in Russian Vol 29, No 4, Apr 86 (manuscript received 16 May 85) pp 89-91

[Article by V.I. Matveyev, Moscow Higher Technical School imeni N.E. Bauman]

[Abstract] A 1978 article (D. Lloyd, Infra-Red Imaging System, Moscow Higher Technical School imeni N.E. Bauman) obtained an expression for the threshold differences of the temperature ΔT_p , which is one of the generalized criteria of the quality of infra-red imaging devices. However, in the derivation of an expression for ΔT_p , the effect on the signal-to-noise ratio of differences in the emissive power of objects was not taken into account, although a change of the emissive power $\Delta \epsilon$ can lead to a significant error in determining ΔT_p , particularly in the case of low-temperature objects. In the present article an analytical expression is obtained for the threshold difference of the temperature ΔT_p with allowance made for changes of the emissive power of objects and the effect of $\Delta \epsilon$ on ΔT_p is evaluated for typical operating conditions on infra-red imaging devices. The article is recommended by the Department of the Elements of Instrument Devices. Figures 1; references 3: 2 Russian, 1 Western.

6415/9716

CSO: 1860/263

OPERATING MODES OF CRYOTRON CONTROLLED BY RADIATION FROM HETEROJUNCTION LASER

Leningrad IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: PRIBOROSTROYENIYE in
Russian Vol 28, No 12, Dec 85 (manuscript received 15 Oct 84) pp 59-61

[Article by O.G. Vendik, A.Ya. Zayonchkovskiy, S.G. Kolesov and L.L. Tereshenko,
Leningrad Electrotechnical Institute imeni V.I. Ulyanov (Lenin)]

[Abstract] A thin-film cryotron controlled by the radiation from a hetero-junction laser is examined. A niobium film $0.2 \mu\text{m}$ thick applied by cathode sputtering in a vacuum on a polished sapphire substrate is employed. The radiation source is a $0.5 \mu\text{m}$ heterojunction laser, from which the radiation is fed to the irradiated portion of the film to a quartz light guide. The response of the superconducting structure to impulse radiation from the hetero-junction laser is investigated experimentally with small current passing through the film. The experiments indicate that stability of the film resistance of $\pm 3\%$ under normal conditions stabilizes the laser supply current to within $\pm 1 \text{ mA}$, which corresponds to stabilization of the output power to within $\pm 0.05 \text{ mW}$. Figures 3, references: 5 Russian.

6900/9716

CSO: 1860/165

NOISE TOLERANCE OF AMPLITUDE-PHASE MODULATED OPTOELECTRONIC SYSTEMS IN PRESENCE OF INTERNAL RECEIVER NOISE AND SPATIAL CLUTTER

Leningrad IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: PRIBOROSTROYENIYE in
Russian Vol 28, No 12, Dec 85 (manuscript received 4 Feb 85) pp 62-67

[Article by V.A. Kazakov and S.A. Afrikanov, Ryazan Radiotechnical Institute]

[Abstract] The noise tolerance of optoelectronic measurement systems are analyzed under dynamic, nonlinear conditions on the basis of Markov nonlinear filtering of continuous processes. The statistical characteristics of the background clutter are analyzed, and the accuracy of determining the coordinates of the object is assessed. The variance of the filtering error of the coordinates of a stationary isotropic Gaussoidally correlated background is analyzed by computer as an example. The findings agree well with the conclusions reached in other studies, indicating that the proposed method can be used to calculate the noise tolerance of amplitude-phase optoelectronic systems in the presence of moving random backgrounds. The use of nonlinear filtering theory makes it possible to allow for continuous, as well as abrupt, changes in the characteristics of the object in the background. Figures 5, references 9: 8 Russian, 1 Western.

6900/9716

CSO: 1860/165

ANALYSIS OF PHASE-TYPE OPTOELECTRONIC IMAGE MOVEMENT RATE STABILIZER BASED ON MULTIELEMENT RADIATION DETECTOR

Leningrad IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: PRIBOROSTROYENIYE in Russian Vol 28, No 12, Dec 85 (manuscript received 12 Oct 84) pp 67-73

[Article by I.N. Kondaurov and V.A. Solomatin]

[Abstract] Two versions of phase-type image movement rate stabilizers are examined: One in which the elements in the radiation detector are switched sequentially (row by row) and one in which a raster consisting of bands of equal width are implemented on a multielement detector. The operation of the stabilizers is analyzed, and their accuracy is assessed. Formulas are derived for the signal spectrum and the image movement rate measurement error for the two scanning methods. The rate measurement error due to internal noise is smaller by a factor of (N/π) for the "band" raster than for element-by-element sampling under otherwise equal conditions. Figures 4, references 2: 1 Russian, 1 Western.

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UDC 681.2(520)

SELECTION OF OPTIMAL DEVICE STRUCTURE CONSIDERING MEASUREMENT SIGNIFICANCE CRITERION

Leningrad IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: PRIBOROSTROYENIYE in Russian Vol 28, No 12, Dec 85 (manuscript received 11 Jun 84) pp 73-79

[Article by P.P. Kuzmin, N.N. Lyashenko and N.A. Fedukova, Leningrad Water Transport Institute]

[Abstract] This study addresses the selection of the optimal structure for a measurement system by taking into account the factors that influence measurement accuracy and limiting their number. The optimal structures are found by identifying the set of variables to which the lowest measurement cost for given accuracy corresponds, identifying the set of variables that provides the best measurement accuracy for a given cost, and finding the set of variables that minimizes the risk function $H(s, \sigma)$, where s is the measurement cost, and σ is the standard deviation. These problems are solved by finding the relationship between the standard deviation σ and the selected set of factors. The structure of an optoelectronic angle measuring instrument is analyzed as an example. The proposed measurement significance criterion is found to be one of the basic indicators that characterizes a device, and can be used to find the optimal structure and to select the technical treatments that govern its construction. Figures 2, tables 1.

6900/9716
CSO: 1860/165

SOME RESULTS OF INVESTIGATION OF TRANSVERSE FOCUSING ERROR

Leningrad IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: PRIBOROSTROYENIYE in Russian Vol 28, No 12, Dec 85 (manuscript received 5 Oct 84) pp 79-83

[Article by S.M. Latyev and A.A. Solovyeva, Leningrad Institute of Precision Mechanics and Optics]

[Abstract] Studies are described that were conducted to obtain data for calculating the component of the probable error of an optical instrument (such as the practical limiting error) due to transverse focusing error: The scattering distribution of the error, the occurrence of systematic components of the error and their causes, and factors that cause the amount of the error to change as the device is operated. The studies were performed on an optical system in which the alignment error of two grids was measured by a micron gauge during repeated re-focusing. The effect of the type of light filter, illumination, aberration, and direction of alignment were investigated. The calculation of the error is explained, and recommendations are given for reducing the error. Figures 4, tables 1, references: 5 Russian.

6900/9716

CSO: 1860/165

UDC 621.375.826:621.785.616

CO₂ LASERS FOR THERMAL HARDENING OF STEEL AND CAST IRON

Moscow ELEKTROTEKHNIKA in Russian No 3, Mar 86 (manuscript received 27 May 85) pp 5-7

[Article by A.S. Borodachev and M.B. Gutman, candidates of technical sciences; G.K. Rubin, doctor of technical sciences, and L.A. Medvedovskaya, candidate of technical sciences, All-Union Scientific-Research Institute of Electro-thermal Equipment]

[Abstract] Various means of economizing electrical energy by the use of laser units for work hardening of mechanical engineering parts are described. As an example the advantages of using lasers in treatment of U8A and Kh12M steel punches with a maximum diameter of the lip of 24 mm were investigated. Tests of the experimental batches were conducted on the plant presses of the Novomoskovskbytkhim Production Association. As another example, a process for laser work hardening of the casing for the differential of the rear bridge of the MTZ80 tractor was developed. The possibility is shown of a significant economy of energy expenditures from the use of the process for laser work hardening, principally because of the localization of heating. Figures 2.

6415/9716

CSO: 1860/239

TIME SEARCH FOR PULSE SIGNALS OF SINGLE-ELECTRON PHOTODETECTORS

Kiev IZVESTIYA VYSSHIKH UCHEBNIKH ZAVEDENIY: RADIOELEKTRONIKA in Russian
Vol 28, No 3, Mar 86 (manuscript received 4 Feb 85) pp 100-103

[Article by K.Ye. Romyantsev]

[Abstract] A study is made of the process of searching for pulse signals assuming that the photosensor channel utilizes a single-electron photosensor which allows separate recording of each photoelectron. Detection of the moment of arrival of a light pulse is based on the assumption that the light pulse repetition frequency is known at the receiving end. In the receiving channel, the output process of the photodetector is compared to a threshold level. Operation of the threshold device at a time less than the repetition period shifts the system into a waiting mode, during which time the channel will not react to the single-electron photosensor for a time equal to the repetition period minus an uncertainty interval. The probability of proper detection can be increased to over 90% by proper selection of the uncertainty time and operating threshold. Figures 3, references: 3 Russian.

6508/9716

CSO: 1860/232

UDC 535.317.1

STATISTICAL MODEL DESCRIBING OPTICAL IMAGE OF ASTRONOMICAL OBJECT DISTORTED BY ATMOSPHERE AND SPACE SPECTRUM OF THAT IMAGE

Gorkiy IZVESTIYA VYSSHIKH UCHEBNIKH ZAVEDENIY: RADIOFIZIKA in Russian Vol 29, No 3, Mar 86 (manuscript received 22 May 84 after revision 26 Oct 84) pp 274-280

[Article by P.A. Bakut, A.D. Ryakhin, K.N. Sviridov and N.D. Ustinov]

[Abstract] A statistical model is constructed for describing the optical image of an astronomic object, an image formed by a telescope and distorted by atmospheric turbulence. The diameter of the telescope aperture is assumed to be much larger than the space correlation radius of atmospheric distortions of the optical radiation field, as in most practical cases under normal meteorological conditions. Only phase distortions are appreciable, in the astronomic approximation of an atmospheric screen, their statistical distribution being a normal one with zero mean and a dispersion much larger than 2π so that the distribution becomes approximately uniform within the $-\pi, \pi$ range. If the atmosphere is further assumed to be "frozen", then the optical radiation field produced in the plane of the telescope aperture by a monochromatic point source has a log normal distribution with zero mean. The space spectrum of a distorted image and its statistical model are obtained by Fourier transformation of its intensity distribution. The space spectrum of a real and therefore large astronomic object is more Gaussian than the instantaneous

transfer function of the atmosphere-telescope system, which has important implications for synthesis and analysis of optical objects. Figures 1; references 13: 5 Russian, 8 Western.

2415/9716

CSO: 1860/249

UDC 533.951

EXPLOSIVE BUILDUP OF ELECTROMAGNETIC FIELD AT PLASMA BOUNDARY DURING INTERACTION OF SURFACE WAVES AND WHISPERING GALLERY MODE

Gorkiy IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOFIZIKA in Russian Vol 29, No 2, Feb 86 (manuscript received 17 Jul 84) pp 139-144

[Article by V.F. Kovalev, V.V. Pustovalov, and M.A. Savchenko, Moscow Institute of Radio Engineering, Electronics, and Automation]

[Abstract] Nonlinear interaction of waves with positive energy at a curvilinear sharp plasma boundary is examined, interaction which results in decay such waves. The possibility of explosive buildup of the electromagnetic field at such a boundary is demonstrated in the case of two short-wave surface modes and a long-wave whispering gallery mode, assuming a cylindrical boundary with vacuum inside and a homogeneous plasma with uniform charge concentration outside. Such a cylindrical boundary forms a resonator. Solution of the corresponding wave equations, for two short-wave surface modes with respective frequencies ω_1, ω_2 and a whispering gallery mode with frequency $\omega_1 + \omega_2$, and application of the law of energy conservation yield an explosive buildup of the amplitude of all three waves. This is a consequence of electromagnetic energy flowing from the plasma region across the boundary into the vacuum and the attendant redistribution of energy in space. Numerical estimates for a cylinder 10 mm in diameter, a metal plasma outside, and a laser emitting 1 J - 0.1 ms pulses of ultraviolet radiation as source of surface waves, yield a field explosion time of the order of 10^{-9} s for purely azimuthal surface waves. References 6: 5 Russian, 1 Western.

2415/9716

CSO: 1860/215

UNIFIED APPROACH TO ESTIMATION OF AGING RATE FOR EQUIPMENT AND COMPONENTS ON BASIS OF UNIVERSAL THERMODYNAMIC MODEL

Kiev ELEKTRONNOYE MODELIROVANIYE in Russian Vol 8, No 2, Feb 86 (manuscript received after revision 26 Nov 84) pp 52-55

[Article by Igor Valentinovich Kulikov, candidate of technical sciences, senior scientific associate]

[Abstract] The validity of applying the universal thermodynamic model of the aging rate $V = Ae^{-E_a/kT_e + \Delta h/kT}$ to electronic components and equipment is established by analysis of test data pertaining to resistors (MLT, SP3, SP5), capacitors (K53, KM, K52), diodes (D-411, D310), transistors (2T203B), optrons (30T110A), and microcircuit chips (K504NT2B, K140UD8A). This model allows, accordingly, for different aging mechanisms in different temperature ranges and changes of aging mechanism in time. Here E_a is the aging activation energy and Δh is the change in specific heat as a result of phase transformations, $\Delta h = 0$ during testing at temperatures T (absolute) below the critical. The model can serve as tool for estimation of the natural aging rate on the basis of accelerated tests, with use of data on the drift of parameters which determine acceptability or rejectability. An analysis of the aging processes according to this model indicates that long life of equipment will be ensured by components with a high aging activation energy and a low dynamicity, the latter implying a slow drift of critical performance parameters. Tables 1; references 4: 3 Russian, 1 Western (in Russian translation).

2415/9716

CSO: 1860/206

TROUBLE SHOOTING OF CONTINUOUS OBJECTS ON BASIS OF THEIR SOUND-CONDITION MODELS

Kiev ELEKTRONNOYE MODELIROVANIYE in Russian Vol 8, No 2, Feb 86 (manuscript received after revision 3 Dec 84) pp 56-59

[Article by Aleksandr Valentinovich Latyshev, candidate of technical sciences, senior scientific associate, Institute of Modeling Problems in Power Engineering, UkSSR Academy of Sciences, Kiev]

[Abstract] The problem of trouble shooting a faulty continuous object on the basis of its sound-condition model is solved using the same input signal and the faulty-condition output signal. For this the object is assumed to contain distinguishable subsystems which generally may overlap. It is furthermore assumed that only one subsystem can be faulty. Taking into account the extent of trouble shooting and with the discernibility of faults established on the basis of a theorem pertaining to undistinguishable subsystems, the principle of this method is applied to inertialess objects and to dynamic objects with a separable inertialess part. The respective algorithms of fault locating are in each case based on a validating theorem. A specific example demonstrates the practicality of this method. References 6: 5 Russian, 1 Western (in Russian translation).

2415/9716
CSO: 1860/206

HIGH SPEED, WIDE BAND ANALOG INTEGRATED MICROCIRCUITS

Moscow MIKROELEKTRONIKA in Russian Vol 15, No 2, Mar-Apr 86 (manuscript received 23 May 85) pp 109-113

[Article by T.M. Agakhanyan, Moscow, Engineering-Physics Institute]

[Abstract] The increasing need for high-speed and wide band analog devices indicates a need for mass production of universal analog devices, probably based on integrated operational amplifiers. The characteristics required by such devices are noted. The development of these devices must be done in consideration of the requirements placed on integrated analog devices in circuits in which they will be used. The first of these is the requirement for stable operation of the analog devices with feedback without the use of integrating correcting circuits. The second problem results from the formation of powerful voltage and current bursts when steep pulse signals are transmitted or during amplification of the high frequency spectrum of harmonic signals. The most effective means of solving these problems is the use of a high speed channel connected in parallel to the element of the integrated circuit with the greatest inertia and the least steepness of characteristic. The high speed channel has a correcting influence because connection of the channel forms a band some distance from the coordinate origin, the remaining bands are shifted toward the coordinate origin and a null is formed which decreases the phase shift in the high frequency area and thus increases stability. Figure 1, references 9: 7 Russian, 2 Western.

6508/9716

CSO: 1860/244

CALCULATION OF TEMPERATURE FIELDS IN HYBRID INTEGRATED MICROCIRCUITS

Moscow MIKROELEKTRONIKA in Russian Vol 15, No 2, Mar-Apr 86 (manuscript received 19 Jun 85) pp 173-179

[Article by R.R. Babayan, P.I. Retinskiy, V.I. Glushchenko, A.F. Bikulov, A.P. Zhukov and N.V. Morozova, Institute of Control Problems]

[Abstract] The temperature of hybrid integrated circuit structural elements can be calculated using a heat flux equation which is an analog of Ohm's law. A more promising method of calculation is that of mathematical modelling. This article studied hybrid integrated circuits in which conductive heat transfer occurs from one or both large surfaces of the substrate in any combination with the ends. The circuits are assumed to have a rectangular multilayer structure. Experimental studies have demonstrated that the method suggested for calculating the temperature fields in hybrid integrated circuits is more precise than those presently used, having an error of 2 to 3% as opposed to 10% for present methods, but requires large amounts of machine time. Figures 2, references 6: 5 Russian, 1 Western.

6508/9716
CSO: 1860/244

UDC: 539.293:535-36

INFLUENCE OF SMALL DOSES OF GAMMA RADIATION ON STRUCTURE OF MICRODEFECTS AND ELECTROPHYSICAL PROPERTIES OF SILICON SINGLE CRYSTALS AND EPITAXIAL LAYERS

Moscow MIKROELEKTRONIKA in Russian Vol 15, No 1, Jan 86 (manuscript received 23 May 85) pp 36-41

[Article by V.G. Mokerov, S.N. Nikiforova-Denisova, Ye.N. Ovcharenko, V.P. Panosyuk, V.I. Smirnov, Yu.A. Timoshnikov and I.P. Chernov, Scientific Research Institute of Nuclear Physics, Tomsk Polytechnical Institute imeni S.M. Kirov]

[Abstract] A study is made of the effect of gamma quanta on the swirl picture of microdefects in silicon single crystals as well as the electrophysical characteristics of silicon single crystals, epitaxial layers and devices based on them. The study was performed on twenty plates 76 mm in diameter doped with boron with a specific impedance of 10 ohm·cm and orientation $\langle 111 \rangle$, separated into two equal parts by laser scribing. One-half of each plate was bombarded with gamma quanta, dose $5 \cdot 10^4 \text{R}$, then both parts were heat treated in a diffusion furnace in moist oxygen at 1200°C for one hour for better visualization. The oxide was removed, then they were subjected to selective etching for 3 minutes. The studies indicated alteration in defect structure as a result of bombardment of low doses of gamma radiation. Depending on the initial state of the material, microdefect density may or may not be preserved. Alteration in defect structure leads to a change in such important parameters

as generation lifetime of current carriers and leakage current of p-n junctions, the direction of change of which varies even within a single plate. Figures 4, references 16: 11 Russian, 5 Western.

6508/9716
CSO: 1860/221

UDC: 621.382.535.21

INFLUENCE OF POWERFUL LASER RADIATION ON CHARACTERISTICS OF THIN SILICON NITRIDE FILMS

Moscow MIKROELEKTRONIKA in Russian Vol 15, No 1, Jan 86 (manuscript received 18 May 84) pp 42-45

[Article by Ya.O. Royzin and Khan Su Khuan, Odessa State University]

[Abstract] A study is made of the effect of accumulation of changes in electric characteristics under the influence of neodymium laser pulses with energy density below the threshold of visible damage. After irradiation, conductivity becomes significantly more heterogeneous. In specimens of Si_3N_4 implanted with boron and phosphorus ions the only effect observed was an additional increase in penetrating conductivity. Laser annealing of radiation defects in the substrate was not observed. The fact of increased heterogeneity of conductivity over the area indicates heterogeneity of absorption. This is possibly due to the presence of inclusions in the matrix of silicon nitride, transparent at the laser wave length. Partial restoration of the initial structure of defects occurs upon annealing. Figures 3, references 9: 7 Russian, 2 Western.

6508/9716
CSO: 1860/221

UDC: 621.382:681.14-32

BUILT-IN HARDWARE FOR SELF-TESTING OF LARGE INTEGRATED CIRCUITS

Moscow MIKROELEKTRONIKA in Russian Vol 15, No 1, Jan 86 (manuscript received 14 Nov 84) pp 70-76

[Article by V.N. Yarmolik, Minsk Institute of Electronic Engineering]

[Abstract] Problems of the synthesis of hardware for self-testing of VLSI integrated circuits to achieve the maximum completeness of testing of these devices are quite important. This article determines necessary and sufficient conditions for a generating polynomial used to formulate a sequence of pseudo-random test signals for this purpose. The sufficient conditions are satisfied by selecting a generating polynomial for which there is no linear dependence between the symbols in the test set. The procedure for selecting the required polynomial is quite complex. The use of the method here described for synthesis of the test sequence generator can reduce the complexity of the synthesis procedure, decreasing the length of the test sequence and the hardware complexity of the generator. Figures 2, references 17: 11 Russian, 6 Western.

6508/9716
CSO: 1860/221

PARASITIC INDUCTION IN HYBRID MICROCIRCUITS

Moscow RADIOTEKHNICA in Russian No 3, Mar 86 (manuscript received 1 Mar 85)
pp 37-39

[Article by B.A. Putilov]

[Abstract] A simple method of calculating induction interactions in a non-homogenous medium is considered. It is particularly effective during analysis of stray (spurious) couplings which occur in hybrid integrated circuits (HIC) at relatively large intervals. A qualitative analysis and an evaluation of the level of stray couplings in a HIC model are described and a comparison is made of the experimental and calculated data. Figures 2; references: 4 Russian.

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CSO: 1860/243

EFFECT OF DIFFRACTIONAL DIVERGENCE OF ELASTIC WAVES ON CHARACTERISTICS OF
ACOUSTOOPTICAL SPECTRUM ANALYZER

Gorkiy IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOFIZIKA in Russian Vol 29,
No 3, Mar 86 (manuscript received 10 Dec 84) pp 374-376

[Article by V.V. Molotok and B.P. Razzhivin, Leningrad Institute of Aviation
Instruments Design]

[Abstract] An acoustooptical spectrum analyzer with an isotropic light-sound guide in the modulator and a Fourier lens behind the modulator is considered for evaluation of the effect of diffractive divergence of harmonic elastic waves propagating through such a modulator on the linear measurement error, other causes of this error being attenuation of the elastic waves through absorption and frequency constraints on their diffraction of light waves. The analyzer performance is described, in terms of a space integral representing a two-dimensional Fourier transformation, for a plane harmonic light wave obliquely impinging on the modulator and diffracted by the acoustic wave traveling through the latter. Calculations in the approximation of a weak sound and of a light wave in the first diffraction order only indicate that divergence of elastic waves during diffraction causes a weighting of the spectrum of the input signal. This lowers the level to which the amplitude-frequency characteristic may drop from 0.7 to 0.6 and thus allows using in the acoustooptical modulator a piezoceramic transducer plate 3 times thinner than according to the conventional radio engineering criterion. Figures 3; references 6: 5 Russian, 1 Western (in Russian translation).

2415/9716

CSO: 1860/249

DIFFRACTION OF SURFACE ACOUSTOELECTRIC PULSE BY SHIELD EDGE

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 31, No 1, Jan 86
(manuscript received 20 Aug 84) pp 197-200

[Article by V.V. Popov]

[Abstract] Diffraction of a surface acoustoelectric δ -form shear pulse by the edge of a metal shield on Class C_{6v} piezoelectric plate is analyzed, assuming here that not the entire surface of this plate has been metallized and that the plate has a sixth-order symmetry with respect to an axis normal to its surface. The diffraction field is calculated by the Wiener-Hopf method with approximate factorization, after preliminary Laplace and Fourier transformations of elastic displacement and Coulomb potential in the piezoelectric plate. With no diffraction field existing before the pulse has reached the shield edge, elastic displacements in the volume-scattered field after the pulse has reached the shield edge occur only at distances from that edge smaller than st (s - velocity of volume shear wave, t - time). Figures 1; references: 2 Russian.

2415/9716
CSO: 1860/210

UDC [621.335:625.2.012.858.538.65]:621.313.13-12

VERTICAL OSCILLATIONS OF HIGH-SPEED GROUND-TRANSPORTATION VEHICLE WITH
ELECTRODYNAMIC SUSPENSION ABOVE ROADBED OF FINITE WIDTH

Novocherkassk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ELEKTROMEKHANIKA in
Russian No 1, Jan 86 (manuscript received after revision 11 Feb 85) pp 5-13

[Article by Aleksandr Sergeyevich Rodionov, lecturer, and Vladimir Ivanovich
Astakhov, candidate of physico-mathematical sciences, assistant professor,
Novocherkassk Polytechnic Institute]

[Abstract] Vertical oscillations of an HSGT vehicle with electrodynamic suspension moving at a constant horizontal velocity above a roadbed of finite width are analyzed, these particularly critical principal oscillations being produced by interaction of the traveling magnetic field and eddy currents in the roadbed. They are described by a nonlinear ordinary second-order differential equation. The rigorous formulation takes into account "armature reaction" of the roadbed and its effect not only on the position of the vehicle but also on the vertical component of its velocity. In the more approximate formulation the second effect is disregarded and the levitation force in the dynamic mode is assumed to have the same magnitude as during quiescent motion with the same nominal clearance. In reality the levitation force on the vehicle in the dynamic mode is equal but opposite to the vertical component of the reaction force on the roadbed and, since the magnetic induction in the roadbed is known for a given external magnetic field, only the sheet density of eddy currents in the roadbed must be determined for calculation of these forces. It is found from the corresponding Maxwell field equations, considering that the velocity of the vehicle is much lower than the velocity of light in vacuum, and with the aid of the Biot-Savart law. A solution to the nonlinear differential equation of motion can then be obtained by numerical integration using the Hemming predictor-corrector. The problem was simulated on a YeS-1022 digital computer for a vehicle weighing 40 tons and moving at 400 km/h. Three transient responses were evaluated: 1) to a jump change of the electrical clearance, 2) to a periodic unevenness of the roadbed structure, 3) to a jump change of the electric current in the bearing circuit. The results indicate that the "steady motion" analogy does not adequately describe the dynamics of such a system with a roadbed of finite width, while the rigorous approach reveals a damping of oscillations and an increase of the natural frequency. For this particular vehicle a 10% jump of the bearing current was found to generate a control force equal to 44% of the weight, oscillations not becoming unstable

with the maximum change of mechanical clearance not exceeding 10% but the maximum acceleration exceeding the permissible level up to 0.6g. Figures 4; tables 1; references 6: 4 Russian, 2 Western (in Russian translation).

2415/9716
CSO: 1860/211

UDC [621.335:625.2.012.858:538.65]:621-313.13-12

CALCULATION-EXPERIMENTAL INVESTIGATION OF LIFTING, BRAKING, AND PUSHING FORCES
ON MODELS OF SINGLE-POINT ELECTRODYNAMIC SUSPENSION

Novocherkassk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ELEKTROMEKHANIKA in
Russian No 4, Apr 86 (manuscript received 12 June 84) pp 51-56

[Article by Ludmila Filippovna Boronina, candidate of technical sciences, assistant professor, Leningrad Polytechnical Institute; Sergey Vladimirovich Vasilyev, candidate of technical sciences, senior scientific-research worker, Leningrad Polytechnical Institute; Anatoliy Ivanovich Kiyenko, senior scientific-research worker, Leningrad Polytechnical Institute; Svetlana Stepanovna Proskurenko, candidate of technical sciences, assistant professor, Dalnevostochniy Polytechnical Institute, and Asa Stanislovovna Chernysheva, candidate of technical sciences, Dalnevostochny Polytechnical Institute]

[Abstract] Experimental investigations were conducted on laboratory models constructed at the Leningrad Polytechnical Institute, differing from those well known, from which the levitation characteristics are obtained of a system of electrodynamic suspension. Experimental data concerned with the lifting, braking, and pushing forces obtained from various models are presented. Figures 4; references: 5 Russian.

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